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Final report

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[1] *The proposal was led by Mr.Vincent Johnson (report co-author) and submitted by him on behalf of ICC.*

Executive summary

The International Coconut Genetic Resources Network (COGENT) is tasked with ensuring the effective conservation, exchange, and use of coconut genetic resources worldwide. This ACIAR-DFAT project GP/2018/193 has supported maintaining COGENT's as an organization to sustainably continue its international initiatives. It has ensured an effective transition from EU-based former COGENT host, Bioversity International to the Jakarta-based International Coconut Community (ICC). As a strategic start, the project was able to boost the active participation of COGENT's International Thematic Action Group (ITAGs) in knowledge sharing and technology development for coconut germplasm management. Moreover, the project is expected to deliver the status report on coconut genetic resources held in trust in the five international coconut genebanks (ICGs) and in the national collections in 19 coconut growing countries (NCGs) for restoring a functioning coconut germplasm multilateral exchange system. Likewise, the project is expected to help develop a mechanism to foster income-generating components and international research collaboration to help sustain the COGENT program and the national and international germplasm collections in the longer term beyond this project.

Based on the project workplan, building the new COGENT Program was a major activity alongside finalizing and launching COGENT's Global Strategy which was published in 2018, after seven years of consultation. An equally important work activity was the assessment of the status of the global genetic resources held in the five ICGs and several NCGs with the aim of addressing the needs of the genebanks and improving the management of germplasm collections**.** Developing income-generating mechanisms in order to help sustain the COGENT program and coconut genebanks in the longer term has been initiated.

For the key result areas of the project, the orderly transfer of COGENT to ICC was achieved with the appointed full-time COGENT Coordinator in October 2021. As such, regular meetings and interactions with the International Thematic Action Group (ITAGs) were held and considerably reactivated the participation of ITAG leaders and members. In the case of financial and administrative management of ICC, support to COGENT was realized. In the same manner, a strong foundation and provision of technical support for starting to implement the Global Strategy Plan for conservation, exchange and use of coconut genetic resources were established. Annual Steering Committee (SC) meetings from 2020-2022 for activity planning, review of the COGENT membership, voluntary technical support of ITAGs despite the restrictions due to COVID-19 in these project years were conducted. These were made possible through face-to-face and virtual consultation meetings, planning workshops, trainings, and symposia. For setting unified directions and goals, inclusive strategic planning workshops for Road Map crafting and the logical framework of priority key areas were deliberated through action planning with the ITAGs. These series of activities were conducted for resource mobilization through the preparation of research proposals. As an aftermath of these activities, the key areas supporting the crafting of the Global Strategy Road Map were identified including: a) Strengthening germplasm conservation and exchange; b) Genomics and Breeding; c) Coconut germplasm crop protection and integrated pest and disease management for Coconut d). Development of Coconut Tissue Culture and Cryopreservation Protocols for operative conservation and better germplasm exchange

The strategic locations of five ICGs, distributed in five coconut-growing regions are critical to revitalizing these regional genebanks. They are located as follows: for Africa and the Indian Ocean (ICG-AIO) in Côte d'Ivoire; for south Asia and the Middle East (ICG-SAME) in India; for south east Asia (ICG-SEA) in Indonesia; for the south Pacific (ICG-SP) in Papua New Guinea, and for Latin America and the Caribbean (ICG-LAC) in Brazil Participatory appraisal of the technical aspects, policy compliance and genebank management was initiated from 2020-2022 and conducted by an appraisal team from various fields of specialization. For this year, integration of the collected data into the COGENT database was planned for updating using a new database program with the technical support of the Centre de Coopération Internationale en Recherche Agronomique pour le Développement

(CIRAD). The rapid appraisals reveal critical challenges and gaps in genebank management, the status of the collections and the effectiveness of germplasm exchange. Thus, appropriate recommendations to upgrade technical capacity, information management, infrastructure, accessions, and help develop a sustainability plan were proposed by the appraisal team for compliance of the host countries of the International Coconut Genebanks (ICGs). There are 144 local, and 170 foreign accessions reported in these ICGs with the highest number of foreign accessions in Côte d'Ivoire (ICG-AIO) and more local collections in India (ICG-SAME).

The project also aimed at fostering income-generating components and international research collaboration to help sustain the COGENT program and the national and international collections over the longer term. Business models of the proposed income-generating activities for adoption of ICGs were completed and 23 proposals were prepared including the most recent submission to the Access the Benefit-Sharing Fund of the Food and Agriculture Organization of the United Nations (FAO). ITAGs' proposals for submission to donor agencies and proposed engagement of private sector through Public-Private Partnerships (PPPs) were also included in the pipeline of activities. Additionally, a consultative meeting on technology commercialization with the private sector was conducted both formal (roundtable discussions) and informal meetings with private sector representatives.

In conclusion, support to the international initiatives sustained the activities outlined within COGENT's Global Strategy. Maintaining COGENT as the coconut germplasm conservation network is indispensable when we consider the socio-economic importance of the crop on a global basis. The track record of COGENT should be reflected for its contribution in managing coconut diversity, germplasm distribution and crop improvement. Thus, it is crucial that the following proposed recommendations based on lessons learned and best practices from the implementation of this project must be continued with the provision of support from donor agencies and engagement of the private sector. There are seven major areas to consider:

a) **Program design and monitoring and evaluation** for clearer strategy and focus on the adoption of either the Theory of Change (ToC) or Logical Framework approach (LF), depending on donor preference. This will help reflect indicators, baseline data, targets and assumptions and risks in ensuring that impact is properly measured.

b) **Reactivating existing COGENT member countries** to boost and revitalize country membership, functionalities and benefits of member countries have to be re-defined in the membership regulations highlighting the complementation of support and roles of ICC and COGENT. Presently, only 16 out of the 39 COGENT member countries are members of the ICC and the remaining 23 countries have yet to be coordinated to become members of ICC.

c) **Adoption and strengthening effective strategic communication and information dissemination system.** Expand utilization of tools for broader global reach to refresh awareness and interest on germplasm conservation, exchange, utilization, and mass propagation which is vital for crop improvement, increased crop productivity and quality and improved livelihoods. The need to create and institutionalize a coherent strategy and platform for communications.

d) **Alignment of COGENT's strategy with that of ICC strategy** to be fully coherent, the COGENT strategy should be complementary to that of ICC. This can be done by ensuring the congruence of COGENT's program to the ICC's mandate with the support of ICC and key partners and stakeholders. ICC and COGENT synergies on conservation and utilization must be defined along with clear functions and complementary strategies.

e) **Forging partnerships and collaboration** should be expanded to include research, academic institutions and private companies through collaborative research that will increase the network's ambit. Institutionalize COGENTs collaboration with private sector, research agencies and coconut farming smallholders harmonized within the policies of ICC.

f) **Sustaining the support to COGENT's initiatives and mobilization of resources,** there is a need to realign COGENT's priorities into need/demand-based programming. It is imperative to identify and overcome the roadblocks to germplasm exchange and utilization. Donor networks must be identified in parallel with a good resource mobilization strategy with the adoption of suitable business models for an improved investment portfolio.

g) **Strengthening ICGs and their management**. Informed by the ICG appraisals and a follow up NCG survey, the collections should be upgraded in terms of improving genebank infrastructure; germplasm accessions and data management, including characterisation; technical capacity, links with host countries for policy compliance and biosecurity and business plans for ongoing sustainability. Part of such business planning must include comprehensively valorising the coconut genetic resources which they maintain.

Background

Grown in over 90 tropical countries globally, on more than 12 million hectares of land, coconut is crucial to sustaining millions of smallholder households. The worldwide demand for coconut products (such as coconut water and coconut oil) is growing. Supply, however, is impacted by ageing trees with declining productivity (an estimated 50% of the global landscape are now senile) which urgently need to be replanted. The sustainability of coconut production and livelihoods depending on it is critically contingent on the maintenance of its broad genetic diversity in order to provide the industry with access to new and quality genetic material in the form of early-bearing and higher-yielding varieties as well as traits needed for specific primary and secondary processing along the coconut value chain. Further, this diversity will provide the genetic base to overcome critical biotic and abiotic threats and will help the industry cope to the challenges of climate change. Currently, coconut processing industries are operating below capacity, due to shortage of raw materials. Further increases in farm yields and productivity resulting from improved germplasm supply would benefit coconut farmers to boost their income and support these processing industries, which help provide generation of income through employment of millions of people across the globe.

There are five International Coconut Genebanks (ICGs) strategically located globally with one identified genebank per coconut growing region – Brazil for Latin America, Côte d'Ivoire for African and Indian Ocean, India for South Asia and Middle East, Indonesia for Southeast Asia, and Papua New Guinea for the South Pacific. Accessions in these collections and those planted in 19 National Coconut Genebanks (NCGs) are poorly conserved, suffering genetic erosion, and threatened by many factors. Relatively little germplasm has been internationally exchanged in recent years. Several collecting and conservation activities have been initiated by coconut growing countries but, these activities were neither coordinated nor harmonized, resulting in inadequate germplasm conservation, evaluation and utilization.

The International Coconut Genetic Resources Network (COGENT) with 39 coconut growing countries as members was established by the International Plant Genetic Resources Institute (IPGRI- now Bioversity International). COGENT has the mandate for coordinating efforts to conserve and utilize coconut genetic resources. However international support for COGENT has been scant. This project has aimed to support revitalizing COGENT, to achieve an orderly transition of COGENT's Secretariat from former host Bioversity International to the Jakarta-based International Coconut Community (ICC)[2], and to ensure technical support for the implementing COGENT's Global Strategy for Conservation and Use of Coconut Genetic Resources (the Strategy). This transfer became more appropriated in 2019 by the conversion of the Asian and Pacific Coconut Community (APCC) into the International Coconut Community (ICC) with an expanded mandate to promote the global development of coconut. ICC's transformed status is endorsed by the United Nations. The work has also introduced measures to sustain COGENT within ICC beyond the two-year implementation period.

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[2] *The new organisational name is the International Coconut Community (ICC), replacing the original name the Asian and Pacific Coconut Community (APCC)*

Despite the challenges brought by the Covid-19 Pandemic beginning in February 2020 causing delays in certain aspects of project implementation whereby planned project meetings, workshops and other face-to-face interactions were postponed, cancelled, or reformatted for partial or total on-line interactions, the project has successfully moved forward adopting tools for better communication and sustained implementation through online meetings and frequent communications. In support of these efforts for a sustained implementation, ACIAR also granted a no-cost extension from the initially scheduled project end date of 31 December 2021 to 30 September 2022.

Objectives

The project aimed to deliver:

1. A functioning and sustainable **COGENT Program**, coordinated by a financially accountable ICC, with a full-time coordinator based at ICC, Indonesia, supported by the Secretariat of the Pacific Community (SPC), with an assisting coordinator based at SPC in Fiji, and support staff in Indonesia, with links to the Asia, Africa and Latin American regions (work package (WP) 1).
2. An **implementation workplan and budget** for the Global Strategy, highlighting links to the Pacific region. Part of this deliverable will flow from the **four fully-established International Thematic Action Groups (ITAGs)[3].** The COGENT Coordinator is ultimately responsible for strategy implementation in direct cooperation with ITAG leaders (WP 2).
3. A **status report on coconut genetic resources** held in trust in the five multi-site international genebanks and in the national collections in 19 coconut growing countries, along with **recommendations for restoring a functioning international multilateral system** and initial support for effectively sharing coconut germplasm for the benefit of breeding programs, as a strategy to improve coconut productivity and linked livelihoods, across the Asia Pacific and beyond (WP 3).
4. The two-year project will also foster **income-generating components** and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term (WP5).

Having a fully functional COGENT will play a pivotal role in ensuring the more effective conservation and use of coconut genetic resources worldwide, and will contribute to building coconut stakeholders' capacity and resilience across the value-chain. With COGENT now being embedded within the ICC, the transition offers a golden opportunity to link coconut genetic resources conservation more effectively with their use, and concomitantly improving coconut-based livelihoods for coconut growing households and communities. This project will ensure that the capacity to conserve the genetic diversity of coconut is expanded and contributes to ACIAR's long-term program of work to rejuvenate the coconut industry in the Pacific.

[3] The themes, number and composition of the groups was discussed in the last COGENT SC meetings (see annex 5.1 for original ITAG design and revised proposed listings). Responding to ACIAR/DFAT feedback to make more realistic, COGENT has rationalized the ITAGs as listed above from 7 to 4, and will seek endorsement from the SC, and then reflect any endorsed changes within the COGENT Global Strategy.

Methodology

As stated above, the four specific objectives of this small research activity (SRA) include delivering: (i) a functioning and **sustainable COGENT Program**; (ii) an implementation **workplan and budget** for COGENT's Global Strategy; (iii) a status **report on global coconut genetic resources** along with **recommendations** for restoring a functioning coconut germplasm multilateral exchange system; and (iv) a means to **foster income-generating components** and international **research collaboration** to help sustain the COGENT program and the national and international collections in the longer term. A project workplan was drafted to guide activities required to deliver the stated outputs (see section 6)

Despite the Covid-19 pandemic restrictions during the project implementation period, and with the grace of short project extensions, the team was able to deliver on most of these objectives.

All practices integrated inclusive and participatory approaches wherever appropriate, especially concerning the participation of women, junior scientists, and young scientists.

Work Package 1 (WP1) Building the new COGENT Program.

The terms of reference (TOR) have been reviewed for COGENT program membership duplications, gaps and policy differences emerging after COGENT has been transferred to ICC. Along with the ICC Secretariat, COGENT coordination[4] managed the implementation and completion of project activities. WP1 also integrated inputs from Dr Carmel Pilotti, an SPC-recruited Pacific regional associate technical coordinator (appointed just before prior to project inception).

Along with COGENT's interim coordinator and ICC representatives, an inception workshop was held in January 2020, and a project budget and workplan was agreed upon and the COGENT operating framework was finalized. It was also agreed that the Strategy Implementation workplan and budget will be developed and integrated (WP 2). An exit strategy was developed, by way of a new COGENT roadmap to mobilize resources for the sustainability and continuity of COGENT's initiatives (WP5).

COGENT's **steering committee** (SC) was consulted and participated in programme interactions. COGENT representatives from non-Asia Pacific regions, in both Africa and Latin America were encouraged to participate in grant workshops to guide establishing the means to ensure equitable engagement and support across the global reach of the network.

Involving the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), the Global Crop Diversity Trust, the Integrated Breeding Platform, and members of ITAG1 and ITAG2, the project has begun developing protocols for

[4] implemented by the ad interim coordinator, until ICC recruited a full-time COGENT coordinator from 1st October 2021.

establishing a new open-access, compatible and user-friendly coconut germplasm database. To ensure global consistency, the complete process is planned to include:

i) reviewing database software requirements and formats that align with new coconut traits ontology (part of an ongoing CGIAR and CIRAD initiative);

ii) assessing database administration requirements

iii) migrating historical germplasm data from the now obsolete coconut genetic resources database (CGRD)

iv) identifying/appointing data management officers in each of the five international genebanks (ICGs); and

v) establishing a consistent/ standardised germplasm data collection and management protocol going forwards, that also fills current data gaps, especially for characterisation data, and newly identified traits. It had been agreed that an ICC-based database/IT officer would then ensure this database be appropriately maintained and is accessible.

At the time of writing this report elements of these planned activities have been implemented and are described in section six, objective 3.3 achievements

Along with an ICC-based communications officer, the grant aimed to develop/review a sequence of **communications**, in conjunction with the COGENT and ICC coordinators. A linked communications package was envisaged to include migrating, upgrading and subsequently maintaining the COGENT website, drafting regular newsletters, and ad hoc briefing documents, and establishing an information sharing platform, amongst other elements. The annual publication of a COGENT newsletter has informed member countries, partners, and donors about the present COGENT initiatives and future opportunities and priorities.

ICC and COGENT have reviewed necessary **legal documentation** (Memoranda of Agreement) to ensure program effectiveness and sustainability.

Over the two years, COGENT strengthened its links with the national and international coconut genebanks, and country representatives and partner organizations through a more open and frequent communications and meetings. Contact details have been updated to identify appropriate focal points for more dynamic interactions, including the International Thematic Action Group (**ITAG) leaders**, to effectively coordinate Strategy implementation (see work package 2).

The COGENT Program has continued to respond to recommendations arising from COGENT SC meetings (arising from WP2). It has also ensured the following:

(i) the five International Coconut Genebanks (ICGs) appraisals have been completed (WP3)
(ii) drafted recommendations for upgrading existing coconut genebanks, or creating new genebanks (arising from WP3)
(iii) supported ITAGs and the Steering Committee (SC) to ensure that agreed work plans are carried out
(iv) managed information and provided virtual progress reports

(v) organized ITAG and SC meetings
(vi) provided sound technical and financial management of COGENT activities and resources
(vii) raised public awareness about COGENT
(viii) liaised with the international coconut community, including CIRAD and One CGIAR and
(ix) developed fund-raising strateg**y** through the ITAGs.

The project had aimed to develop a monitoring framework to track progress towards achieving the declared deliverables and goals, but this has been transferred to a series of frequent coordination meetings.

Another key component of COGENT's programme is that of training and capacity building, which has been conducted in the form of online and face-to-face workshops, webinars and virtual symposium covering aspects of all four ITAG themes (e.g., germplasm data management, germplasm hygiene, and tissue culture).

As part of its general operating procedures, ICC is subject to an independent external evaluation, which should also include a COGENT programme-wide evaluation every five years regarding its research program, its central scientific services and the coconut genebanks. The evaluation will address specific questions, issues, and themes, and recommend impact assessments where appropriate. This will provide assurances to external partners and endorse internal M&E processes. Moving forwards, the COGENT programme should become more fully embedded within ICC, especially in terms of memberships and strengthening links to germplasm use, via the rest of the coconut value chain.

As previously indicated, the downstream economic and social benefits linked to the proposed scope can only be realized over the longer term. However, COGENT will monitor progress towards achieving the outcomes and objectives articulated above, especially those relating to users' access and exchange of materials conserved. The genebanks appraisals will establish a baseline in this regard. This will support monitoring of implementing agreements between COGENT with the host countries and genebanks holding and exchanging germplasm. The use of a more standardized monitoring and evaluation tool will be crucial in future impact assessments highlighting milestones, accomplishments, risks, gaps and opportunities to do better in the future incorporating lessons learned for every project implemented.

Work package 2 Finalising and launching a Strategy implementation workplan and budget

Developing a Global Strategy implementation workplan and budget has already been initiated by the coordinator, as a **Roadmap** (see figure 1). Consultations were held with the SPC-based technical officer, Fiji, the COGENT SC, representatives from Africa and Latin America, and input from the ITAGs and ICC. The various activities within the Global Strategy implementation had been assigned to specific ITAGS and other ICC programs as indicated in the table below. Activities are closely linked to WP1, especially with regard to ITAG cross-linkages.

The new full-time project coordinator adapted this outline to formulate the above-mentioned specific Roadmap, which is an evolving document.

Strategy Implementation Area	ICC		COGENT/ITAG			
	Program	Communications	Ex/In situ conservation	Genomics/ Breeding	Phytopah, Ent, Germplasm	TC and Cryo
1. Strengthening commincation and commitment to conservation and use of coconut genetic resources						
2. Revisiting the concept of Global COGENT coconut collection, including (1) genebank diversification, (2) a geostrategic doubling of the number of international genebanks, (3) sharing genebank resources and (4) developing a "networked" or "virtual" coconut collection						
3. Securing existing ex situ coconut genetic resources, including (1) developing business plans for genebanks, (2) extending field accessions' duration and (3) germplasm triplication (including cryobanking)						
4. Strengthening conservation beyond ex situ collections including (1) conservation by use, (2) multi-functional landscape management, (3) integrating ethnobotanical considerations and (4) building awareness on coconut reproduction patterns						
5. Collecting and filling gaps in ex situ collections especially for (1) Compact Dwarfs and others special varieties, and (2) pest and disease resistance, (3) prospecting diversity on isolate islands and/or endangered by climate change; and (4) filling geographical gaps						
6. Strengthening the distribution and the safe movement of germplasm, especially (1) developing/refining policies for international germplasm transfers, (2) more effectively transferring germplasm via embryo culture and pollen, and (3) establishing adequate disease indexing and quarantine centers						
7.Promoting the use of coconut genetic resources, including (1) agreeing on global objectives in terms of planting materials, (2) promoting farmer-produced planting material, (3) better characterization and evaluation of germplasm, (4) establishing a comprehensive network of international breeding trials and (5) researching cloning technology						
8. Improving databases of sharing of technical information, including (1) effective genebank data management, (2) upgrading international databases of ex situ conservation and (3) developing databases for and of farmers						
9. Integrating coconut genomics, including (1) sequencing the coconut genome, (2) preparing for marker-assisted breeding, (3) improving conservation by DNA analysis in ex situ genebanks and (4) DNA analysis in farmers' fields						
10. Enhancing networking and partnerships for global collaboration						

Figure 1: Initial allocation of ITAGs to COGENT Strategy implementation

Work Package 3 Assessing the status of global coconut genetic resources

The grant work has been assessing the **status of coconut genetic resources** held in the five international and 19 national genebanks. It had also considered assessing any *in situ* conservation and elsewhere. In situ conservation will also be linked with any ICG collecting missions.

During the two-year grant period, the appraisal Terms of Reference (TOR) and team composition evolved from the original conception (see annex 5.4), and an appraisal team for each genebank was organized, according to key competences on genebank management, coconut breeding, pest/disease management, agronomy, and socioeconomics. The teams conducted rapid appraisals of the five international genebanks, in a three-step process. The COGENT coordinator ensured the three steps were planned well in advance. In the documentation review step 1, the team requested documentation (see section x), from the genebank. The findings from this review also informed the questions to be asked during step 2, the site visit. All Appraisal Team members and the ICG Curators developed the agenda for the site visit to ensure specific issues and questions were identified for review and relevant stakeholders and users consulted. One or more interactions took place in advance of the site visit, between the Appraisal Team member and ICC-COGENT staff, by email and virtual conference.

The members of the appraisal team conducted ICG site visits following the appraisal protocol as set by the team. The site visits involved interactions with senior officers, researchers, and breeders, as well as the technical field staff following. In support of the secondary documentation gathered in step 1, the team conducted focused group discussion, interviews, ocular observations, and photos/videos documentation to gather the information on the agronomic and biophysical conditions of the gene banks.
After the completion of the appraisal, findings were assimilated (step 3), COGENT Coordinator compiled the appraisal reports for restoring a functioning international multilateral system for effectively sharing coconut germplasm for the benefit of breeding programs to move towards improving coconut productivity and linked to livelihoods, across the Asia Pacific and beyond.

This work contributes towards ensuring the ICGs are managing their germplasm information within a newly-organized germplasm information system and help migrate from the CGRD (see WP1). Workshops were planned to build the capacity of database and information managers.

After the strict continuing quarantine measures for Covid-19, and when international borders have started allowing travels with less stringent requirements, actual visits of the ICGs were made to ICG-SP, Papua New Guinea (November 2019); ICG-AIO, Côte d'Ivoire (February 2021), ICG-SEA, Indonesia (March 2022); ICG-LAC, Brazil (April 2022), and ICG-SAME, India (May 2022). Appraisal reports were compiled which will be published to ICC's CORD journal, articulating the State of the World's Coconut Genetic Resources. This report contains recommendations for upgrading the ICGs to comply with the multilateral system.

Work Package 4: Developing income-generating mechanisms to help sustain the COGENT program and management of the coconut genebanks in the longer term

Using existing ICC and COGENT relationships and networking, the project originally conceived developing at least partial industry-based and governmental and international research collaborative support for COGENT projects, including proposed ITAG activities linked to resource mobilization for specific research grants. The ITAGs have indeed provided significant inputs for resource mobilization, and proposals pipeline have been established. COGENT prepared business models for adoption of ICGs to ensure that they can be self-sustaining in the long-term to encourage host governments to provide adequate and regular budget allocation in maintaining their hosted genebanks. More effective and transparent use of funds generated from producing and selling planting material, coconuts and high-value coconut palm products (HVPs) were recommended. The socio-economic assessment made in the appraisal contributed sustainability planning.

ICC-COGENT is in the process of exploring strategies to generate the needed resources by collaborating with both the national/international organizations and private sectors to be engaged in the development of the industry. Hence, expanding the membership of COGENT to include academic and research institutions is viewed to be the logical approach to afford sustained support to valuable and prospective research undertakings. This can be initiated by developing business plans investment-worthy technologies with impact and potentials.

Achievements against activities and outputs/milestones

Objective 1: To achieve an orderly transfer of the COGENT Secretariat from Bioversity to ICC

No.	Activity	Outputs/milestones
1.1	Face to face inception meeting	Finalized appointment of new COGENT Coordinator
		Developed grant work plan for 2020
		International Coconut Genebank (ICG) rapid appraisals schedule, and ICG management resources requirement estimates
		Reactivation plan for International Thematic Action Groups (ITAGs)
		Plan for the appointment/ ICC allocation of the IT, communications and administrative functions for the COGENT Secretariat
		Agreed Steering Committee Meeting agenda, membership list, dates, delegates list.
		Outline of capacity building & coconut germplasm data management programme developed
		Communications plan developed for website migration & newsletter
1.3	Virtual team meetings	Bi-weekly planning meetings held (Outputs)
1.4	Rescheduling the work plan	Rescheduled workplan and budget to include 6-month delay to end June 30, 2022,
1.5	Newsletter preparation	2 Newsletter editions published; Newsletter 3rd edition drafted
1.6	Website migration Website updating	Completed On-going
1.7	Virtual SC meeting	Meeting held with presentations and discussions
		Report and follow recommendations
189	Finalising new Article 15 ICG agreements	New agreement template and narrative
		2 ICG agreements signed (ICG-SP, ICG-AIO)

Objective 2: To establish the foundation and provide technical support for the initial implementation of the Global Strategy for Conservation and Use of Coconut Genetic Resources.

Activity	Outputs/milestones
ITAG reactivation	List of nominated International Thematic Action Groups (ITAGs) leaders consulted
Identification of priority projects	Projects per ITAG identified (1 submitted, 2 drafted)
Reviewing technical role of SC and other COGENT members	Technical experts' contributions to Virtual SC meeting
Interactions with SPC	New SPC coconut expert ,Dr. Carmel. Pilotti was recruited
Workshop on COGENT strategy implementation work plan & budget	COGENT strategy implementation work plan & budget

Objective 3: To conduct individual appraisals of the 5-international coconut genebanks and provide initial support for the long-term conservation and evaluation of the conserved germplasm and integration of the collected data into the COGENT database.

No.	Activity	Outputs/milestones
3.1	Activities in support of ICGs	Proposals in development for priority accessions safeguarding & duplication
		Proposals in development for biosecurity planning in host countries to
		Technical trainings/ training materials provided on i) germplasm and its data management, ii) on controlled hand pollination iii) TC and cryopreservation
		Bilateral meetings with CIRAD, CropTrust, FAO and International Breeding platform (IBP) germplasm database stakeholders to begin planning training and data migration
3.2	Completion of remaining ICG appraisals	Documentation requirements reviewed, appraisal visits completed, reports compiled

Objective 4: To foster income-generating components and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

No.	Activity	Outputs/milestones
4.1	Developing ICG Fund Generation Schemes	Seed gardens established pollen/ seedling sales, ecotourism park
		Pollen and seedling sales platforms established
		High-value coconut-based products developed
		Bio secure ecotourism ventures established
		Profitable and sustainable intercropping integrated
4.2	Cost Reduction Mechanism for ICG Maintenance to increase Yields	Fertigation measures introduced
		Organic farming regimes established
4.3	National funds provided by Host country	National / regional / private sector budget or funds committed
4.4	International Funds	Development and transfer of coconut tissue culture technology for rapid multiplication of quality planting materials
		Replanting program to replace senile and unproductive farms;
		Breeding for early bearing, high yielding, and dwarf varieties;
		Breeding for drought resistant varieties and hybrids;
		Breeding for pest resistant varieties and hybrids;
		Training on genetic resources conservation
		Commercial Business training facility for producing high-value coconut products
4.5	Funds for COGENT	Industry levies introduced (to be developed)
		Private-sector annual support (to be developed)
		Membership subscriptions (from ICGs in particular) (to be developed)
		Business plan and sustainability plan implemented (to be developed)

Key results and discussion

Objective 1: To achieve an orderly transfer of the COGENT Secretariat from Bioversity to ICC.

The COGENT was transferred from Bioversity to ICC for the continuity of its germplasm conservation activities and to develop a better scheme of coconut germplasm exchange. To have an organized assumption of responsibilities, the thematic areas were the deliverables assigned to the ITAGs to be facilitated by the COGENT Coordinator. Whereas the administrative and financial support services were provided by the ICC Secretariat under the leadership of the ICC Executive Director. In achieving the set of objectives of the project, one of the major components of the project support initiatives in maintaining COGENT is the hiring of the full time COGENT Coordinator. From March 2020 to September 2021, Mr Vincent Johnson was designated as the interim COGENT Coordinator. In October 15-17, 2021 the SC virtual meeting was held, and a new full time COGENT coordinator was appointed. Ms. Erlene Manohar, the former Deputy Administrator of Philippine Coconut Authority and the Country Project Leader of the COGENT Poverty Reduction Project in 2002-2007 was designated to the post. She assumed her post on October 4, 2021 and was able to present the COGENT Global Strategy Plan and the component activities therein as explicitly emphasized during the meeting (Appendix 2).

The appointment of the new fulltime COGENT Coordinator and the scheduled activities and project workplan and budget were implemented. This includes frequent virtual coordination meetings; ICG appraisals, NCG online survey; technical capacity building, and boosting the engagement of COGENT's four International Thematic Action Groups (ITAGs) through virtual consultative meetings. ITAGs reactivation in terms of leadership, membership and identifying priority projects is underway. Technical support links have been greatly strengthened in the Asia-Pacific, Africa, Latin America and the Caribbean and Europe. Supported with ACIAR/DFAT, ICC and some Asia-Pacific governmental resources, ICC has allocated its COGENT programme with communications, financial transaction and administrative support. An agreed Steering Committee Meeting agenda has been implemented in terms of membership and meetings held in 2020 and 2021. A face-to-face SC annual meeting was held in November 2022, after the ICC COCOTECH meeting. COGENT communications through a website linked to ICC have been developed and rolled out, in terms of website migration and updating, and annual newsletters published. A coconut germplasm data management agenda has been drafted, to ensure historical germplasm data can be migrated to an open-access, updated and user-friendly MS Excel-based coconut germplasm information system (CoGIS), linked to Grin Global. Data management contact points are yet to be identified in each ICG, who will be trained once the system is established. The agenda is being implemented with COGENT partners participating. New Article-15 ICG draft agreements have been agreed with ITPGRFA, although will need to be amended and signed following ongoing interactions with host governments, ICC and ITPGRFA.

Thus, given the results outlined above, ICC has largely achieved its first objective of achieving an orderly transfer of the COGENT Secretariat from [ex-] Bioversity to ICC. This is in spite of the constraints imposed by the global Covid-19 pandemic.

However, as the recommendations will indicate (see section on Recommendations), ICC will aim to ensure that adequate resources are available for its COGENT programme to continue in the future. Apart from planned self-sustaining/ income generating resources and ICG business plans, this will also require some (in some cases initially) support from ICG host countries, ICC-COGENT member-countries (perhaps via a revised membership scheme), and ICC's key partners, including ACIAR/DFAT, CIRAD, the Global Crop Diversity Trust, the ITPGRFA, the Alliance of Bioversity and CIAT (or the One CGIAR).

Although a COGENT Roadmap has been drafted, the budget and workplan for implementing COGENT's Strategy Plan is yet to be fully articulated via its ITAGs. Apart from finalizing, fundraising and communications strategies, new ITAG leaders will need to be appointed within the next 6-months, who can provide certain percentage of dedicated commitment, time and other resources needed to ensure the critical involvement of the ITAGs in going forwards. Memberships of the SC, the ITAGs and COGENT member-countries need to be reviewed, and a new SC chair appointed at the 2022 SC meeting. Regional contact points for Africa and Latin America and the Caribbean still need to be identified. All of these will also require a renewed sense of commitment, and be able to respond effectively to COGENT requests and communications.

COGENT's top priority is to continue implementing its Global Strategy despite COGENT's challenging transition and the COVID-19 pandemic. But, with the support of ICC Secretariat and technical back-up of the interim Coordinator, COGENT was able to continue making significant progress. Its quest to conserve and exchange germplasm are major components of improving productivity. Hence, COGENT is committed to support the vision of ICC in improving the socioeconomic welfare of farmers and other industry stakeholders.

Objective 2: To establish the foundation and provide technical support for the initial implementation of the Global Strategy for Conservation and Use of Coconut Genetic Resources.

A. **Steering Committee Meetings of the policy-making body and annual planning.**

Prospects and opportunities arising from implementing COGENT's global strategic plan have been strengthened by increased stakeholder commitment, research advancements and enhancing the policies underlying the strategic plans. However, like any other program, COGENT activities also face challenges and there is a need to address these challenges via plausible strategies and the continuous adoption of lessons learned and best practices during project implementation and from other stakeholders. During the 2021 Steering Committee meeting, major challenges were identified such as the risks facing in situ and ex-situ conservation which were attributed to socio-economic dynamics, emerging pests and diseases, and climate change. Second is limited farmers' knowledge on the importance of coconut diversity and genetic resources which can be enhanced with massive information campaign using various tools and platforms. Complex issues were also raised regarding the availability of quality planting materials, and germplasm movements due to regulatory restrictions and biosafety issues. Added to that are attributed to inefficiency and lack of synergy among ICGs, research groups in ITAGs, farmers and the private sector regarding the conservation and use of genetic resources, resulting from limited interests on the value of genetic resources and conservation.

Moreover, the existing international germplasm databases are not yet linked to any of the various data management initiatives. Hence, there exists only limited support to improve sharing, accessibility, and interpretation of the available information from sources of genetic materials. Unstable host-country support also compromises sustainability and effective management of the genebanks. Strategies must be complemented by practical and doable actions generated from the discussions with member countries such as convergence and cooperation in the conservation approaches and germplasm sharing. Technical strategies developed by ITAGs should be tapped but, it needs sustainable resources for continuity and completion of their research to generate innovative outputs linked to conservation and effective germplasm exchange.

It was emphasized in the SC meeting that to meet industry demand, strategic plans have to be synchronised and accelerated, requiring the full support of an International Coconut Conservation Program as stipulated in the Treaty. To address these issues, and to fulfil funding requirements, sustainable income streams are needed for germplasm conservation and exchange activities. To complement this, winning proposals aligned to donor strategies are also needed. Also, there is a need to link and establish networks for funding mobilization in the national and international sources. Generally, the crafting of the COGENT's Conservation Road Map with well-defined goals, strategies, and unified direction should be of top priority to ensure the continuity and sustainability of ongoing initiatives to promote COGENT as the recognized global entity that supports industry-driven coconut germplasm conservation.

The 2020 SC meeting (July 17-20) focused its discussion on the following concerns:

a) COGENT Membership
b) Crafting of the Road Map
c) Revitalizing the ICGs/NCGs
d) Updating the Germplasm database management system
e) Enhancing ITAGs synergy with the industry and research institutions
f) Support to ICC program and mandate and
g) Completion of the component activities of the ACIAR funded project. In compliance to the SC recommendations and approved project support of ACIAR, initial activities were started.

However, due to the restrictions brought by the COVID-19 pandemic, physical meetings and other activities were limited and are now replaced with virtual meetings in our best attempt to translate plans into actions with due consideration to the health and safety of the implementing team involved.

The 2021 SC meeting highlighted again the need to revitalize ICG and NCG management which is the core of the COGENT conservation program. Thus, a priority recommendation is to prioritize characterizing accessions that are vital to the needs of the industry in relation to market demand for emerging products (i.e., lauric content, sap production and coconut water quality and quantity), aside from the traditional traits of copra weight and high yield. This will provide value added in sustaining coconut conservation. There is also a need to harmonize the data on the performance of the accessions collected in the ICGs/NCGs to establish broader coconut diversity according to a global perspective. Updating germplasm data management is critical. Hence grant work has initiated developing a practical, precise and user-friendly digitized platform that can be accessed by curators and researchers of the COGENT member countries. Moreover, this is essential in the exchange and use of the valuable germplasm for use of the industry. It was recommended for approval of SC the provision of resources to support the dwindling management of the ICGs/NCGs and to develop a succession plan for curators and researchers to ensure sustainability. Specifically, the following strategies were emphasized during the meeting:

1. Strengthen the partnerships with the ICGs host institutions/policy makers and review the MoUs, treaties and agreements through inclusive consultations.
2. Enhance synergy through sharing of information/research outputs and consultative interactions among ITAGs (i.e., conferences, workshops).
3. Adopt the double-headed leadership of ITAGs with Senior and Junior experts to engage the younger scientists to co-lead the ITAGs as succession plan for sustainability.
4. Engage the local research institutions working on coconuts and support networks such as funding institutions as member of the ITAGs of COGENT.
5. Promote and harmonize ITAGs activities and outputs through conferences, workshops and other means.

However, these strategies should be carried out with appropriate activities and targets based on the thematic areas of concern of the four ITAGs of COGENT. It is fundamental that strategic planning should be anchored within COGENT's Global Strategy and must start from the appraisal of ICGs' status, and setting logical objectives and unified directions. These can only be done by crafting a conceptual framework as the foundation of developing the COGENT Road Map.

B. **Crafting the Roadmap for the Global Strategy of Conservation & use of coconut genetic resources**

Withing the proposed conceptual framework of COGENT's Coconut Conservation Road Map, the chain of thematic areas for coconut germplasm conservation are technically linked to the four ITAG areas of concern respectively. It is indispensable that the plans and directions of each ITAG are geared towards coconut diversity protection and germplasm utilization. These should be interconnected to achieving the conservation of genetic resources for economic utilization in the quest for producing superior quality planting materials. Coconut germplasm conservation, exchange, selection and utilization must be sustained to supply growing market demands and prospects of emerging high-value coconut-based products, Specifically, ITAGs thematic areas were identified with the following concerns:

a) ITAG1 deals with the ex-situ and in-situ conservation, preservation and germplasm exchange of collected germplasm.
b) ITAG2 strategy is geared towards utilization of genetic resources for varietal improvement through breeding to produce potential hybrids for massive production for the purpose of increase in yield or pest and disease resistance.
c) ITAG3 is responsible for formulating pest and disease control measures adopting Integrated Pest Management (IPM) principles.
d) ITAG4 focusses on developing, validating and optimising CTC and cryopreservation protocols partly via enhancing the capabilities of the various laboratories of the member countries with CTC facilities.

As reflected in the Conceptual Framework of the COGENT Road Map (Figure 2), ITAG4 shall support ITAG1 in the management and rejuvenation of the germplasm collections of the ICGs/NCGs. Whereas, for ITAG 2, CTC technology shall be used for mass propagation and hybridization of selected genotypes for use and distribution. This supports more effective germplasm exchange and biosafety protocols for safe germplasm movement using tissue-cultured plantlets as clean planting material for distribution to requesting countries. These synergistic initiatives of the ITAGs are facilitate germplasm conservation and utilization that will rationalize the value of supporting COGENT's Global Strategy. This is translated into the Strategic and Comprehensive Road Map for better management of the conservation, exchange, and use of genetic resources with a set of targets and milestones with respective timelines. This road map also includes the implementation mechanism and monitoring with identified measurable indicators of the outcomes and outputs as determinants of the physical accomplishments congruent with the project objectives. The road map crafting was anchored in the thematic areas such as R&D support, capacity building, promotion, proposal development. resource mobilization and management with set of key activities for 5-year period. Continuity will be based on the outcome of the 5-year plan to have proven outputs that are worth considering and re-thinking of the impacts of the achievements for the welfare of the coconut growing communities and the sectors of the industry (Figure 1).

In early 2022, initiatives to have virtual ITAG workshops were tried, however, due to differences in time zones, organizing the workshop was challenging and was not pursued. Instead, 2nd semester of 2022, the COGENT Coordinator conducted series of consultative and coordination meetings and sought the cooperation of the ITAGs in this undertaking. With reference to the Global Strategy Plan, ITAG members who are considered experts in their thematic areas were tasked to discuss their agreed directions, strategies and activities/milestones on given timelines. The COGENT coordinator provided the guide matrix to organize their insights and harmonized the insights feedbacks. Despite challenges, ITAGs 3 and 4 were able to develop their desired strategies and priority activities. Based on the series of consultations, key areas were identified using the virtual interactive platform (Tables 3 and 4).

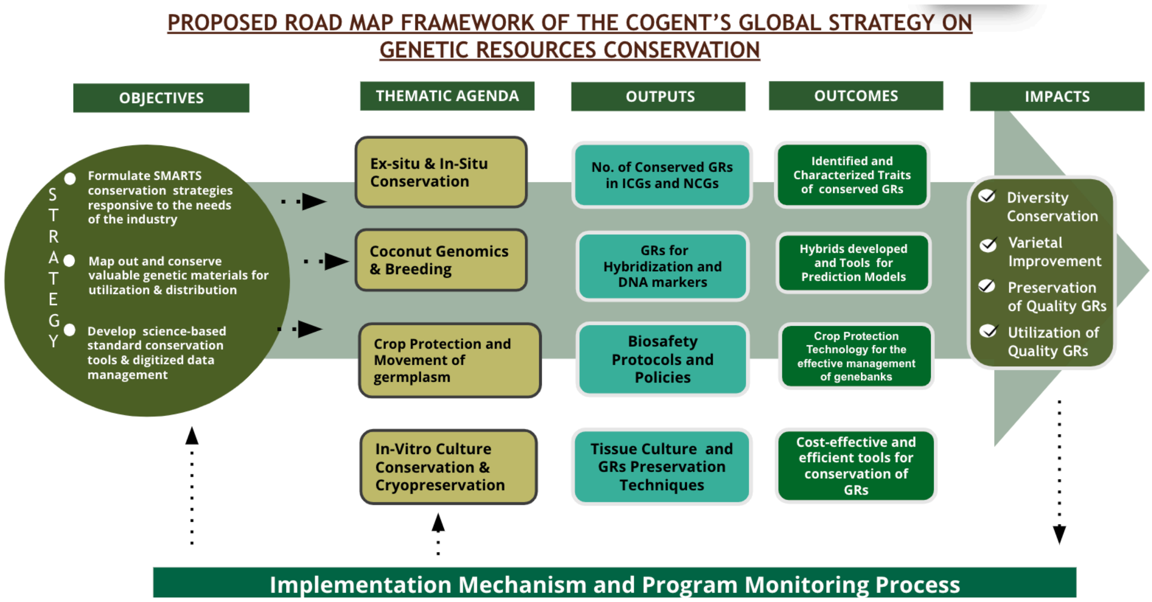

Figure 2: Conceptual Framework of the COGENT's Global Strategic Road Map

C. Key Areas and Activities in support of the COGENT's Global Strategy Road Map

Strengthening Germplasm Conservation and Exchange

1. Conducted ICG Participatory Rapid Appraisals (PRA) and Consultation Meetings with the curators and research team of the host institutions of ICG-SEA, ICG-LAC and ICG-SAME.
2. Harmonized the appraisal outputs of the five ICGs with the concurrence of the respective curators and research team of the host institutions.
3. Developed the activity plans through the Participatory Action Planning for the rehabilitation and better management of ICGs.
4. Proposed drafting the Biosecurity Protocol for effective management of genebanks and for more effective germplasm exchange.
5. Planned a consultation meeting with policymakers of the host countries of the genebanks to review compliance to the treaty and renewal of the MoUs of the ICGs.
6. Organized series of meetings with curators, breeders, data management experts and IT specialists to discuss updating the existing germplasm data collection and management system.
7. Accessed the CGRD data of ICGs for updating, access and utilization of data. Planned workshop/training for curators and database managers and development of practical and user-friendly database management program.

Development of Coconut Tissue Culture and Cryopreservation Protocols for operative conservation and better germplasm exchange.

1. Conducted of the 2nd International Coconut Tissue Culture and Cryopreservation Symposium, Workshop/Training and Round Table Discussion with the private sector from May 6-18, 2022.
2. Documented activities through the proceedings of the three activities with abstracts of the technical topics for uploading to the new ICC-COGENT website
3. Crafted the Comprehensive R & D program for Coconut Tissue Culture during the workshop in CPCRI-India.
4. Trained forty researchers representing host institutions of the ICGs and NCGs on the developed Coconut Tissue Culture and Cryopreservation protocols. (List of trainees and their institutional country affiliation
5. Established the state of the art of the CTC and cryopreservation technologies and identified the challenges and gaps of the priority activities
6. Harmonized the CTC and cryopreservation protocols developed by the various laboratories engaged in the coconut tissue culture research.
7. Enhanced technology sharing and unified research direction of CTC and Cryopreservation R & D program.
8. Documented the demonstration and hands-on Training of the developed protocols via video recording for use of the trainees in their respective laboratories.

As an aftermath, of the symposium, there are elements of the CTC technology that were realized in pushing for utilization. These elements are upscaling. sharing and enhancing the existing protocols as expressed by CTC experts. However, these elements should be supported by synergies among the key actors of the CTC R & D networks and support institutions. This will trigger interaction among the researchers, policy makers and funding institutions that can provide the resources needed to augment the limited funds to achieve one direction and advocacy for CTC. Publishing an overall CTC guidelines document is planned

Crop Protection and Integrated Pest and Disease Management for Coconut

1. Convened the initial discussion meetings with ITAG3 members (August 5, 2022) to plan out for the priority activities for implementing safe germplasm movement.
2. Prepared the structured activity plan from August to December 2022. drafted by COGENT Coordinator for deliberation of the ITAG3 members on August 15, 2022
3. Developed the ITAG3 workshop module for action planning on Crop Protection set on November 2022 back-to-back with the COCOTECH Conference in Kuala Lumpur, Malaysia as agreed during the meeting.
4. Planned webinars for Phytoplasma diseases and Coconut Rhinoceros Beetle are the priority activities of ITAG3 for 2023.

Genomics and Breeding

Coconut germplasm conservation is not intended only for diversity conservation, but must align with utilization of selected genotypes with identified desired traits for breeding and mass propagation. The germplasm collections must be identified and characterized for their prospective use both for propagation and hybridization. Breeders have identified genetic descriptors for data collection to assess performance in identifying parent materials for hybridization. All five ICGs have identified accessions with superior traits and these can be included in germplasm exchange and distribution to member countries for expanding genetic conservation and increase utilization. Related to the aforementioned ITAG2 functions, priority research activities will focus on the following:

1. Genome sequencing to ensure authenticity of the germplasm and to establish germplasm correlations
2. Marker development for varietal identification and breeding purposes using Single Nucleotide Polymorphism (SNPs) and Simple Sequence Repeats (SSRs).
3. Genome Sequencing of superior quality germplasm which were already established for *Catigan Dwarf* of the Philippines, Hainan Tall of China and *Chowgat* of Thailand.
4. Continuing research in these areas must be sustained to support modernization in molecular breeding.

Objective 3: To conduct individual appraisals of the 5-international coconut genebanks and provide initial support for the long-term conservation and evaluation of the conserved germplasm and integration of the collected data into the COGENT database.

Prior to the ICG appraisals, it was reported that more than 1,000 coconut accessions[5] representing more than 400 varieties are conserved within five international coconut genebanks (ICGs) and 19 national coconut genebanks (NCGs) across the world. These genebanks were established through COGENT's efforts. As such COGENT organized an appraisal team to conduct the genebank appraisals aimed to assess the following concerns in each genebank (i) hosting agreement status; (ii) management effectiveness; (iii) roles, services and use, and linkages with users and other stakeholders; (iv) performance targets and work plans; and v) collection status within the global context. Based on the findings, the appraisals will recommend appropriate upgrades to technical capacity, information management, infrastructure, and accessions, and help develop a sustainability plan.

Generally, the concern for conservation is primarily focused on preventing loss of crop genetic diversity worldwide. Hence, international agreements have been designed to encourage preservation of genetic diversity and promote the exchange of germplasm. The FAO International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) oversees the activities related to the exchange of germplasm for crops, however, effective

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implementation has been hampered often by lack of consensus among the parties under the treaty on the issue of the value of genetic resources. Thus, challenges of conservation must be addressed to ensure the sustainability of the conservation activities and exchange of germplasm, especially in the case of coconut, being an economically important and long-term perennial crop.

In 1999, COGENT which was previously under Bioversity International, established five International Gene Banks (ICGs) across the Globe designating five member countries as the "**Host Country**" for each of the five ICGs, namely:

i. ICG-SEA (for Southeast and East Asia) in Indonesia
ii. ICG-SAME (for South Asia and Middle East) in India
iii. ICG-SP (for South Pacific) in PNG
iv. ICG-AIO (for Africa & the Indian Ocean) in Côte d'Ivoire
v. ICG-LAC (for Latin America & the Caribbean) in Brazil

COGENT as an international conservation network for coconut intends to achieve these two-pronged objectives in safeguarding and revitalizing the existing ICGs and NCGs: (1) towards improving productivity and (2) protecting coconut biodiversity for future generations. However, the economic importance of conservation in relation to the use of coconut must be assessed to be able to establish the economic relevance of conservation. As such, for this appraisal, the focus is not only on the technical aspects, but also on inclusion of economic valuation and policy implication to achieve a comprehensive and logical appraisal.

Hence, a standard ICG appraisal protocol was developed for systematic assessment of the status of the genebanks' management, germplasm performance and policy compliance. Empirical data and non-subjective observations were considered in the process to formulate strategic recommendations aligned to the set of objectives and agreements under the duly signed Memorandum of Understanding (MoU) and as stipulated in the ITPGRFA of FAO.

Objectives of the Appraisal

In the standard appraisal process in the context of the objectives considered these activities to generate comprehensive appraisal outputs.

1. Review the status of hosting agreements to ensure legal and institutional support
2. Assess the effectiveness and efficiency of the management, operations, facilities, and activities of each of the ICGs.
3. Assess the roles, services and use of the ICGs, and the linkages with users and other partners.
4. Review the status of the ICGs with respect to performance targets and the feasibility of proposed work plans to achieve the targets.
5. Consider the status of individual collections maintained by the ICGs in the context of a global system for long-term conservation and use of the selected coconut accessions in question.
6. Provide actionable recommendations and pathways for the strengthening of the ICGs' operations within the host Government framework and their linkages to COGENT member countries based on perceived country needs.

Specifically, the ICG appraisal teams considered a strategic standard process to be able to determine the gaps and challenges in ICG management and compliance with the MoU-based agreements on and as stipulated in Article 15 of the ITPGRFA. The following steps were followed by the ICG Appraisal Team (IAT) composed of breeder. agronomist, crop protection expert and an economist. Each member of the team focused in their respective areas of concern in assessing the status of management, technical, administrative, policies and economic aspects of the ICGs.

1. Review of the old Memorandum of Understanding between parties (ICG-Host Government, COGENT-Bioversity and FAO-ITGRFA and the new MoU with ICC.
2. Gathering of Baseline Data using the structured questionnaire
3. Coordination and Inception Meeting with the curator and research staff of the ICG
4. Focused Group Discussion for collection of primary and secondary data using key informants.
5. Field Visit and Data Validation
6. Exit Conference with the curator, technical and support staff of the host institution for verification and rationalization of findings
7. Strategic Action Planning and Prioritization of Activities
8. Target Setting in a given timeline and Estimated Budget
9. Recommendations and Conclusions
10. Appraisal Report Writing

The Appraisal Outputs

The five ICGs were appraised with different members of the appraisal team due to travel constraints and availability of the selected appraisal experts. In the appraisal report each ICG respective experts were identified. However, the appraisal process was refined and strengthened after ICG-AIO and ICG-SP had already been appraised with a simpler format. Appraisal reports were validated and verified by the ICG curators and research team involved in the management of the ICGs before these were finalized. A summary of appraisal findings is presented in the following tables, and observations and recommendations.

Table 1. STATUS OFTHE INTERNATIONAL COCONUT GENEBANKS

ICGs and LOCATION	HOST INSTITUTION	NO. OF DESIGNATED GERMPLASM		NO. OF GERMPLASM COLLECTION		SOURCE OF ACCESSIONS
		Local	Foreign	Local	Foreign	
ICG-SEA Manado, Indonesia	Indonesian Palm Crop Research Institute (IPCRI)	**17**	**35**	**17**	**NONE**	North Sulawesi, Central Sulawesi, Bali, West Java, Papua, Moluccas, South Kalimantan Provinces, Indonesia.
ICG-LAC Aracaju, Brazil	EMBRAPA Coastal Tablelands	**13**	**9**	**17**	**9**	Introduction from Côte d'Ivoire and collected at Brazil
ICG-SP Madang Papua New Guinea	Kokonas Indastri Korpersan (KIK).	No data	No data	55	No data	Papua New Guinea
ICG-AIO Marc Delorme Cote' Ivoire	Côte d'Ivoire-CNRA,	No data	No data	27	96	India, Brazil, Cambodia, Cameroon, Comoros (France), PNG, Ghana, India, Malaysia, Mozambique, Panama, Philippines, Solomon Islands, Sri Lanka, Thailand, Tonga, Vanuatu (also Benin)
ICG-SAME Kerala, India	ICAR-CPCRI	**40**	**No data**	**49**	**42**	Sri Lanka, Bangladesh, Indian Ocean Islands, Mauritius, Comoros, Reunion, Madagascar, Seychelles and Maldives
TOTAL				**144**	**170**	

Table 2. STATUS OF THE GERMPLASM CONSERVATION AND UTILIZATION

ICGs	Donated		Received		Utilized	
	No.	Recipient	No.	Origin	No.	Purpose
ICG-SEA	NONE	NONE	NONE	NONE	17	Research Works
ICG-LAC	NONE	NONE	NONE	NONE	10	Breeding
ICG-SP	4	Cameroon	62	BEN, BRA, CMR, COM, FJI, GHA, GNQ, IDN, IND, KHM, LKA, MOZ, MYS, PAN, PHL, PNG, PYF, SLB, THA, TON and VUT).	NONE	Hybrid production
ICG-AIO	88	GHA, IND, LKA PHL, SLB SLK, THA, TZA, VNM, VUT	67	BEN, BRA, CIV, CMR, COM, FJI, GHA, GNQ, IDN, IND, KHM, LKA, MOZ, MYS, PAN, PHL, PNG, PYF, SLB, THA THON, VUTH	--	--
ICG-SAME	NONE	NONE	132	Indian Ocean Is.	21	Breeding and Seed production

Table 3. STATUS, CHALLENGES AND KEY AREAS OF PRIORITY CONCERNS

CONCERNS	ICG-SEA	ICG-LAC	ICG-SP	ICG-AIO	ICG-SAME
General Management	Moderately managed	Moderately Managed	Limited information provided due to transfer issues	Not well-managed, parcels of up to 80 ha hired out to farmer concessionaires, several of whom do not fertilize or manually weed the parcels… many parcels seriously degraded	Sustainability of the good management and adoption of Good Agricultural Practices (GAP)
Land Ownership	Owned by Ministry of Agriculture	Owned by EMBRAPA	New site established owned by KIK	Owned by Ivorian Government, who have agreed some property development concessions	Leased Land from Forest Department
Germplasm Exchange	No germplasm exchange only local collections	With available foreign accessions but not all the designated germplasm were planted	No germplasm donation populations are highly endangered due to BCS	Germplasm collections were introduced from 21 countries and territories in 1960s-1980s, little donated due to LYD threat but, some were sent to Sri Lanka in 2006	Conserved all the designated 49 accessions and with total 323 accessions
Data Management	Encoding to CGRD	Use Alello Program for data encoding	CDM Software for data management adopted but with problems Descriptor completion rates are unacceptably low	CDM software is available and functional on the station. not used by researchers. no user manual for this software. No training on the use of the software.	Encoded to CGRD
Pest and Diseases	No regular surveillance	Reporting of pest infestation and disease incidence	Surveillance made for BCS symptoms and vectors caused by Phytoplasma	LYD surveillance routine, no report on station but, recorded in other parts of Cote d’Ivoire; 2 diseases leaf spot and Phytophthora	Regular surveillance and IPM being done

CONCERNS	ICG-SEA	ICG-LAC	ICG-SP	ICG-AIO	ICG-SAME
Funds Support for Maintenance	Limited budget from government and income from the sales of the nuts	Funds provided by government	Annual expenses: US$86.4K annual income ~US$70K shortfall of $15K-	CNRA provides US$3.5K per month from central funds, for maintenance sourced from, hybrid nut sales ploughed back to the ICG funds	Funding of US$ 60-70K and provided with 9 technical staff, 16 skilled workers, 29 part time and 40 seasonal labour force
Research Support	Limited funds	For IPM and Hybridization	ACIAR has provided funds for phytoplasma vector studies and BCS epidemiology	research funds t for genomics, grant from UK Royal society, funds from FIRCA, and from IAEA for hybridization and LYD studies	Available funds but needs augmentation for sustainability of on-going research activities
Infrastructure, Laboratories and Equipment	Existing facilities and laboratories provided by the government	Provided by the government with laboratories, facilities and machineries	No data provided during the appraisal, multi-site genebank to be established	Supported by from CNRA, labs are available but degraded below standard	Full support of ICAR with 13 laboratories, warehouse and greenhouse that need improvement
Policies and Administrative Support	No stable regular support staff and non-compliant to the agreement	Compliant to the agreement but with limited support staff	KIK provides full administrative support, but information flow remains intermittent	Not compliant with MLS and to sign new agreement… collection still threatened by development plans	Compliant to the Terms and Conditions of the MoU

Table 4. IDENTIFIED CHALLENGES, CAUSES AND EFFECTS

ICGs	CHALLENGES	CAUSES	EFFECTS	Proposed Solutions	RESPONSIBLE PARTY/AGENCY
ICG-SEA	• Germplasm Exchange • Data Management • Genebank Management	• No clear SOP for strict Germplasm Exchange implementation • No updated data management system	• No compliance from source countries of the designated germplasm • No continuity of data collection (latest is 2016)	• Establish a muti-host country for ICG-SEA from the existing NCGs • Skills training for the curators on updated data management	ICC-COGENT, ITGRFA ICC-COGENT and ICGs
ICG-LAC	• Not fully managed • Lack of regular pest & disease monitoring system • Limited Germplasm Exchange	• Change of curator • No regular surveillance • No addition or donated accessions except for the designated germplasm	• Transition adjustment • Leaf Atrophy Incidence and mite infestation • Sluggish conservation and germplasm exchange	• Designation of alternate curator • IPM adoption and regular surveillance of pests and diseases • Enhance coordination and promotion of the use of the elite collections	EMBRAPA EMBRAPA ICC-COGENT & EMBRAPA

ICGs	CHALLENGES	CAUSES	EFFECTS	Proposed Solutions	RESPONSIBLE PARTY/AGENCY
ICG-SAME	• Sustainability of ICG maintenance • Benefit-sharing in the germplasm exchange • Data management system	• No definite support funding for the ICG • No clear standard policy for all ICGs • Lack of standard software and updated CDM	• Uncertain funds for ICG maintenance • Non-compliance of the member countries • Documentation management risks	• Socioeconomic impact study of the use of germplasm • Access and benefit sharing funds • Data management project to add value to the accessions	ICC-COGENT, CPCRI, FAO-ITGRFA
ICG-SP	• ICG establishment and management • Germplasm movement • Data Management Software	• Plots with risk of germplasm contamination (Talls mixed with Dwarfs • Lack of effective dissemination of data on conserved germplasm • Unprotected data storage and lacks data statistical analyses disks	• Germplasm authenticity • No country requested for ICG-SP conserved accessions. • Unreliable and incomplete data set	Germplasm restoration and transfer Formulation of standard and effective germplasm exchange mechanism • data-gap filling and corrections or provision of an updated database software	KIK, ICC-COGENT

ICGs	CHALLENGES	CAUSES	EFFECTS	Proposed Solutions	RESPONSIBLE PARTY/AGENCY
ICG-AIO	• Incomplete regeneration of accessions • Incomplete characterisation of accessions • Poor germplasm data management • Lack of good, controlled pollination capacity • Poor management of accessions • Threat of LYD • Threat of urban development	• Poor management, low capacity, and funding gaps • lack of staff and capacity • lack of capacity • lack of capacity • accessions poorly managed by contract farmers • neighbouring regions threaten encroachment • Government selling development concessions	• Low regeneration rate • Low levels of characterisation • Lack of access to comprehensive germplasm datasets • Backlog of CHP required • Accessions in poor shape • Uncertainty that accessions are infected with LYD • Whole collection threatened with obliteration	• Provide funding and capacity building for CHP, regeneration and characterisation programme • Develop and implement common germplasm data management systems • Review system of farmer concessionaires and implement stricter monitoring/ and (dis) incentives • Regular molecular diagnostics Continuous LYD scouting • Introduce new stricter agreement and compliance with Article 15	CNRA, ICC-COGENT CNRA CNRA ITPGRFA, Min of Ag, ICC

[1]**Note: The three top challenges**

Identified Key Constraints of the ICGs and Proposed Strategies

CONSTRAINTS	STRATEGIES	RESPOSIBLE AGENCY
Lack of clear mechanism to protect germplasm ownership of the country of origin	Adoption of IPR as legal basis of ownership in the germplasm exchange	ICC-COGENT (ITAG1), ITPGRFA, ICG host countries, IPO
Authenticity of the germplasm for exchange and distribution which are on the basis of phenotypic characterization	Use of DNA markers as basis of the national and international registration system of germplasm collections of the genebanks	ICC-COGENT (ITAG2,), ITPGRFA, ICGs, germplasm donor countries
Lack of clear benefit-sharing mechanism for germplasm conservation and exchange	Formulation of equitable and practical benefit sharing system in the conservation and germplasm exchange	ITPGRFA, ICGs, ICC-COGENT, ICG host countries
No standard biosecurity protocol specific for coconut to safeguard country of destination and source	Development of standard and science -based international biosecurity protocol aligned to the national regulatory policies of the donor and ICG host countries.	ICC-COGENT (ITAG 1, 3 & 4) ICGs and ICG host countries
Uncertainty of the commitment of host countries for ICG sustainability	Review of the Article 15 of the Treaty and renewal of the MoU and regular ICG appraisal	ICC-COGENT, ITPGRFA, ICG host countries

5. Inclusion of the NCGs in the proposed multi-country conservation at the regional level.
6. Conduct of virtual appraisal of the participating NCGs to institutionalize their engagement in the comprehensive conservation and germplasm exchange agreements in accordance with Article 15 of the treaty

Objective 4: To foster income-generating components and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

Income-Generating Initiatives

Based on the outputs of the ICG appraisals, there exists uncertainty of the sustainability of the ICGs and NCGs. Hence, the provision of income-generating initiatives is vital to augment genebank resources. Coconut being a long-term crop, ex-situ and in-situ conservation demands huge land area and secured management fund sources. In some ICGs, a major challenge is land ownership and permanent use of the land for the germplasm collections. In the same manner that ICG management is usually neglected due to limited resources for maintenance and operations of other related activities. To strategically address such challenges, development of business plans for income-generating activities is deemed to be the solution. Intercropping with high-value companion crops can be a major scheme of generating income from the ICGs, in certain agroecological and other contexts. Managing intercrops in genebanks also comes with some logistical and agronomic caveats. As reflected in Table 7, there are initiatives that are proven economically viable and worth conducting Coconut-Based Farming Systems

(CBFS) that are income-generating and beneficial to farm productivity of the ICGs/NCGs. Based on the economic indicators of profitability, the cost-benefit ratio is in the range of 1.76 to 2.82 and the ROI for coconut-coffee intercropping combination is as high as 76%. The least is the coir production as an additional income from farm wastes utilization (Appendix 3).

This business plan also included nursery establishment of seedlings and selling the nut or processed copra from the nut harvests from the ICG farms. Moreover, hybridization activity as initiated by some of the ICGs is logically worth-considering for ICG's to have stable fund support for maintenance of the genebanks. Conservation and use of germplasms are of paramount importance to increase productivity through varietal improvement and selection of varieties with superior traits. Maintenance of ICGs/NCGs and regeneration of germplasm must be prioritized.

Table 7. Summary of the economic indicators of profitable coconut-based income generating enterprises for ICGs/NCGs.

Coconut Technology	Average Total Cost (USD)	Average Total Revenue (USD)	Average Net Income (USD)	Average Return on Investment	Average Benefit-Cost Ratio
Coffee-Coconut Intercropping	1,136	1,965	829	0.76	1.76
Cacao-Coconut Intercropping	830	2,190	1,360	1.56	2.56
Banana-Coconut Intercropping	809	2,093	1,284	1.82	2.82
VCO – Coco Flour	39,565	63,921	24,356	1.08	2.08
Coir	14,307	17,351	3,044	0.82	1.82

Note: Assumptions were based on the Philippines situation

Networking and Linkages with Research and Funding Institutions

Establishing a genebank support system via a sustainable fund generation strategy is a priority area to be set by COGENT. Proposals can be developed with the Steering Committee to access funding support that can be achieved through networking and linkages. The COGENT Coordinator and ITAG leaders and members have been prioritising research topics within the four ITAGs key areas.

Between January 2020 and October 2021, the interim coordinator and ICC technical working group chair coordinated the development of 18 proposals totalling a bid of US$12 million, ranging across all four ITAGs and also linked with other ICC work, one of which was endorsed. (see Annex 9). Although proposals were not endorsed, they represented a first important step in ITAG collaboration and will be useful in recycling for future submissions.

From October 2021 onwards, the new coordinator coordinated proposal development as follows:

For ITAG1, Sustainable and Enhanced Conservation, Utilization and Rehabilitation of genebanks for Exchange and Distribution of coconut germplasm or (SECURED) was submitted to Benefit Sharing Fund (BSF) of FAO in July 29, 2022. (Annex G). ITAG2 has developed and submitted a collaborative proposal on coconut pangenomics to the Chinese government. ITAG3 is developing a full proposal for possible submission to ACIAR entitled IPM-COCOGENE (Integrated Protection and Management of Coconut Genebanks). In the case of ITAG4, a concept proposal for a comprehensive tissue culture R & D Program was developed during the CTC workshop/training in India with participants from the five ICGs and elsewhere with guidance of CTC experts from various laboratories working on coconut tissue culture and cryopreservation protocols. The COGENT Coordinator also drafted the project proposal CocoCARES for the Emergency Relief Fund of ITPGRFA [Coconut conservation approaches for rehabilitation and enhancement of the strategy plan for ICGs & NCGs (COCO-CARES)]

The Global Crop Diversity Trust has very recently expressed renewed interest in Coconut conservation, and requested information on coconut genebank running costs, so there may be an opportunity to tap into endowment funding from the CropTrust.

Sustainable Resource Mobilisation Strategy and ITAG Plans

The ITAGs' collective reputation and scientific research outputs provide a strong foundation for engaging with international organizations and donors. ITAGs must develop of outcome-based proposals with direct impact for coconut value-chain stakeholders especially small-scale farmers, particularly women. Hence, interactions and brainstorming have been planned for developing compelling, relevant and practical investment-worthy proposals worth.

A series of virtual consultative meetings was organized by the COGENT coordinator for each ITAG to engage members in cohesive discussions. The COGENT coordinator discussed with each ITAG the process of strategic action planning and setting unified directions with the corresponding activity targets, resources and timelines. With such challenging consultation platforms with the ITAGs, at least 2 hours per ITAG was allocated virtually on specific days and time convenient to most of the members. So far, ITAG4 and ITAG3 have crafted initially their priority activities per strategy using a logframe matrix template prepared by the COGENT Coordinator as the pathway in crafting the COGENT's road map. For ITAG1 and ITAG2, getting the participation of most members has proved more difficult due to uncertainties in scheduling, availability and time-zoning challenges. However, despite this difficult task, persistence has stimulated an active ITAG engagement. Synergy and convergence among the members within their respective ITAG and between ITAGs were established. During the consultative meetings there were conflicting views and arguments, but organized discussions and agreements were established.

Furthermore, most ITAG members recommended having a face-to-face workshop for an effective discussion on project output sustainability plans. It is COGENT's fervent desire to establish sustainable support mechanisms as part of an exit strategy. However, a limiting factor is posed by financial constraints to rolling out a physical platform for an ITAG workshop or mini conference back-to-back with the COCOTECH conference. COGENT is committed in pursuing its comprehensive and inclusive Road Map despite many challenges, but sustainability and continuity of these initiatives must be considered. Thus, a sustainable fund generation is the utmost priority to the worth-conserving initiatives of COGENT.

Part of any sustainable resource mobilisation strategy should include a valorisation of coconut genetic resources, from which the industry benefits enormously, but these benefits do not flow equitably to the smallholder farmers as primary producers, nor do they accrue to the ex- or in-situ guardians of diversity- the genebanks and farmers respectively. Industry levy schemes and endowments from various sources (including the Global Crop Diversity Trust) may help offset the costs of conserving these valuable, if not priceless genetic resources.

Impacts

Scientific Impacts

Research is a key means of achieving COGENT'S strategic aims for coconut germplasm conservation and use to sustainably boost the coconut industry and those stakeholders dependent on coconut's economic value. Over the grant period, ICC-COGENT has strengthened its research links with collaborating institutions to pave the way for future work. This includes the links forged within and between the ITAGs, and their interactions in prioritizing elements of their proposed research agendas.

Achieving the goal of effective genetic resources conservation and their use necessitates a thematic agenda for mass propagation, breeding for disease resistance and safe movement of germplasm. Coconut tissue culture (CTC) and cryopreservation research critical for scientific advancement. Via ITAG 4, the grant work has begun unifying the direction of CTC and cryopreservation research and development (R&D) generating synergies and knowledge sharing that will help fast-track standardization and optimization of the available protocols. The CTC symposium and workshop provided impetus to foster knowledge sharing and collaborative efforts to move forward and expected to address the challenges of germplasm conservation, exchange, and breeding activities for coconut. As a result, the global coconut community is in a much better position to collaborate in effective mass propagation of clean, elite panting material that will help more effectively conserve coconut genetic diversity, and improve its use in breeding programmes. This is good news for national replanting programmes. Furthermore, the renewed scientific momentum provided by ITAG2 in sequencing the coconut genome and developing new molecular markers will improve the extent and depth of coconut characterisation, via higher throughput genotyping and phenotyping. Ongoing collaborations within ITAG 3 on pest and disease diagnostics and biosecurity will also have a significant impact on more effectively controlling key regional pests and diseases, such as phytoplasmas and CRB, to allow for safer germplasm movement. Within ITAG 1, the findings from the ICG appraisals will assist ICGs to comply with ITPGRFA Article 15, and ensure more effective and comprehensive conservation of representative coconut diversity

Capacity Impacts

The strategic process of building an effective network is dependent on capacitating key players that will execute proposed activities to realize project outcomes. Capacity building is critical to achieving objective 2 on establishing technical support. Engaging junior researchers in the ICG and ITAGs' activities will help sustain implementation of the global strategy. The participatory approach in the ICG appraisals has also built researcher awareness of the importance of conservation and incentivized sharing insights.

The strong technical support of the ITAGs especially ITAG4, the training/workshop conducted in India has built a strong foundation for CTC R&D. Knowledge sharing among researchers (senior and junior) has positively impacted valuable technology transfer that will contribute to sustainability. Long-term science-based activities are anchored in the continuity of research generation. Thus, more capacity building activities have been planned with other ITAGs to guarantee achieving the set of goals of this project.

Community Impacts

The grant work has built a foundation of scientific collaboration that helps translate the strategic push towards germplasm conservation and use that will help secure coconut-farming communities' welfare in the mid- to long term. The exit strategy is expected to create triple effects drawing significant attention, interest and participation of farmers in the conservation, protection and sustainability of coconut production and livelihoods revolving around this crop. Conservation strategies must be multi-level considering not only the mere collection of accessions but also conservation at farm level and lastly, the utilization of coconut traits in the processing industry. Although coconut germplasm conservation poses significant challenges due to the crop's physical size, germplasm collection and nature as a perennial and recalcitrant crop, effective conservation is still possible when given comparatively more time than for other crops. Despite the complexity of conservation efforts, this grant work has emphasized the need to sustain coconut genetic diversity because of its ecological, cultural, and socio-economic value.

Over millennia, more than 400 widely diverse coconut varieties (>1500 accessions) have been identified, and improved varieties have been developed from this single-species genus. Through the support of CGIAR, Bioversity International[6] and its partners, and commitments under the ITPGRFA of the contracting countries, in-situ and ex-situ conservation through the International and National Coconut Genebanks (ICGs and NCGs) were established and maintained under tripartite agreements between Bioversity[7] (COGENT), ITPGRFA and the genebank host governments.

In the context of selecting and utilizing germplasm of superior quality and with special traits from the conserved varieties, COGENT initiatives under this project will ultimately influence coconut-farming communities' livelihoods. Conservation and germplasm utilization can offer a transformative approach in changing the existing coconut landscape. Low productivity has helped push coconut-farming communities into poverty, mostly due to senility of coconut palms, and now the increasing effects of climate change, and pest and disease susceptibility. Planting improved varieties in terms of agronomic traits, productivity and quality is critical to increasing income from coconut farming. Although community impacts are not yet evident, if the ITAGs implement their prioritised programmes, this will ultimately generate positive outcomes for these communities

It has been emphasized in a former COGENT poverty-reduction project that "**Coconut Farmers Need not be Poor**" (Batugal et. al, 2009). However, historical dependence in most coconut growing countries on traditional varieties and copra production is inevitable, Thus, coconut farmers have been deprived of the maximum benefits from the crop. Coconut is a way of life to provide food, energy, shelter, and health. Conserving coconut germplasm and distribution this for utilization of quality planting materials will significantly boost livelihoods in coconut-growing communities. COGENT's global strategy includes connections to the industry's needs for narrowing the gap between demand and supply. This will result to more

[6] now part of the Bioversity-CIAT Alliance, and being integrated into the new One CGIAR

[7] originally registered as the International Plant genetic resources Institute (IPGRI), and since 2018 COGENT hosting has been transferred to the International Coconut Community (ICC)

equitable distribution of benefits for producers and processors. The main means of poverty alleviation is increasing income from through improving farm productivity, partly by using the best varieties available. Hence, sustainable conservation of coconut germplasm and its economic use is COGENT's ultimate aim. Using the superior germplasm conserved by the genebanks for mass propagation and safer germplasm exchange can be supported by the research outputs of the ITAGs. These will directly and indirectly address poverty prevalent in coconut-farming communities.

Communication and Dissemination of Activities

Despite the COVID-19 restrictions, activities on communication and information dissemination were undertaken using various online tools. During the pandemic years (2020 to 2021) two appraisal reports were submitted for review and were not published or uploaded to the COGENT website. For the current year, a new COGENT webpage with the updated structure and the ITAG leadership and membership were included in the ICC website. Updated information and documentation of ITAG activities were uploaded. This contains, information about COGENT's functions, the organizational structure, country membership and the Global Strategy. Newsletters were published in 2020 and 2021, and the 3rd newsletter for 2022 will be published in 2023. .

The CTC proceedings of the symposium, workshop and the round table discussion with the private sector was uploaded to serve as communication platform under the publication. Moreover, a video documentation of the workshop will be uploaded to the website after editing by ITAG4 members. ITAG members proposed having an information brief or flyer for dissemination, and to attract new members with the aim of expanding membership to the research and academic institutions. A review of the country membership is underway to update outdated contact details of some COGENT representatives and their member countries.

9. Conclusion and Recommendations

Generally, the project initiatives have contributed to helping achieve the key objectives outlined within COGENT's Global Strategy. Maintaining COGENT as the coconut germplasm conservation network is indispensable when we consider the socio-economic importance of the crop on a global basis. Moreover, the historical track record of COGENT has essentially contributed to the development of coconut diversity, germplasm distribution and crop improvement. As such, continuity of supported international initiatives by COGENT is imperative to ensure sustained and effective biodiversity protection, germplasm exchange and utilization. The following are the proposed recommendations based on lessons learned and best practices from the implementation of this project:

Program Design and Monitoring and Evaluation

For more systematic, fair and accurate projects and programs monitoring and evaluation, a clearer strategy in rethinking the program design can focus on adopting either the Theory of Change (TOC) of Logical Framework Approach (LFA), depending on donor preference. This will help reflect indicators, baseline data, targets and assumptions and risks in ensuring that outputs, outcomes and impacts are properly measured.

- The Monitoring and Evaluation tool is also helpful for accurate reporting against time and budget, outputs, outcomes, and impact and translating our lessons learned and best practices into useful strategies in future projects.
- The TOC or LFA is helpful in conducting an evaluation/audit (whether internal or external, independent or outsourced) and in project / program management regardless of size (single donor vs multi-donor programs) and duration. The TOC and LFA has always been the language of the donor community and the development sector, for better assessing the status quo, and proposed solutions to problems. These approaches help better establish realistic target milestones, and assess gaps and opportunities, thus providing a clearer picture of what a successful project looks like. Reports generated from the logical framework can help efficiently prioritize projects and programs and earmark budget to maximize impact. Through the adoption of these approaches, we are able to handle projects better from ideation, to project document preparation, implementation and end-of-project assessment in accordance to the short-term and long-term plan of the ICC-COGENT Roadmap.

Expanding Country membership

- To boost and revitalize country membership, functionalities and benefits of member countries must be re-defined in the membership regulations highlighting the complementation of support and roles of ICC and COGENT. Presently, only 16 out of the 39 COGENT member countries are members of the ICC and the remaining 23 countries have yet to be coordinated to become members of ICC.
- Appointment of county-based representatives as national COGENT focal points (institutionalized) by the Country NLO (if they are member of the ICC)/ Ministry of Agriculture for non-ICC member
- Upgrading and aligning regional COGENT membership is needed to level-up agency and influence.
- Review of membership and institutionalize within the higher level of policy making.
- As an initial step, harmonizing the membership guidelines of COGENT with the membership policies of ICC should be a priority. Moreover, having co-leadership of ITAGs with one senior and a junior researcher/expert should be considered.

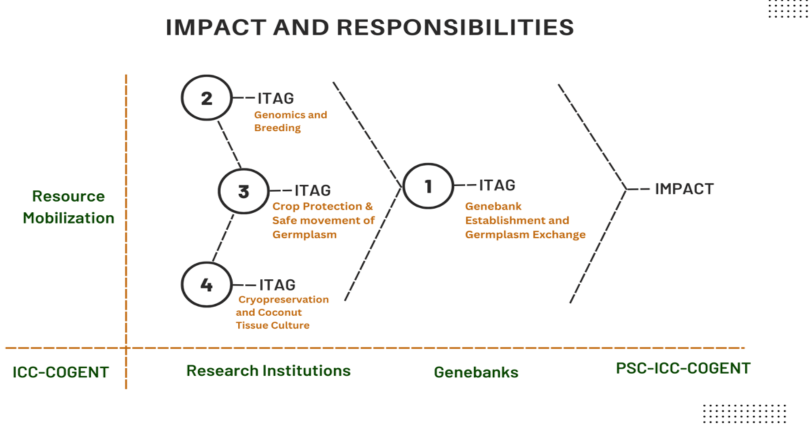
Communications

- An effective strategic communication and information dissemination system must be strengthened and expand utilization of tools for broader global reach to refresh awareness and interest on germplasm conservation, exchange, utilization, and mass propagation which is vital for crop improvement, increased crop productivity and quality and improved livelihoods.

- There is a need to create and institutionalize a coherent strategy and platform for communications with two defined functions:
  (1) Interactive feature with feedback mechanism to address the needs of the industry through consultations and engaging in planning workshops
  (2) Providing information, updates and visibility to the member countries, private sector and donor community through:
    a. Publications and IEC materials
    b. Visibility- field presence
    c. Visibility- through social media presence

Functional responsibilities of ICC and COGENT

- Align COGENT's strategy with ICC strategy, efficiently oriented towards producers, consumers and processors. To be fully coherent, the COGENT strategy should be complementary to that of ICC. This can be done by ensuring the congruence of COGENT's program to ICC's mandate with the support of ICC and key partners and stakeholders. Moreover, direction setting geared towards supporting the major concerns of the industry will lead to harmonizing policies and plans of COGENT as a major program of ICC.
- ICC and COGENT synergies on conservation and utilization must be defined along with clear functions and complementary strategies.



Gender and Social Inclusivity

- Gender and social inclusivity goes beyond inclusion of women project team composition. Considering that the nature of this project is a policy-level, gender lens is perhaps less applicable. However, within COGENT-linked initiatives, an equitable representation of gender, youth, indigenous group needs must all be integrated, going forwards.

Considerations for conservation.

- COGENTs regular monitoring and appraisal system of the ICGs and NCGs needs to be institutionalized to protect germplasm and maintain the genebanks with full time curators and germplasm data managers to be provided by the host institutions as policy of the host countries to be stipulated explicitly in their revised Article 15 agreements. The Crop Trust has expressed some recent interest in this regard.

- A multi-country representation of genebanks per region could be considered where appropriate, to ensure the comprehensive backup of the collections, and to offer contingencies in case of unavoidable causes of germplasm loss due to calamities or notifiable pest or disease incursions.
- Incentives or agreements must be established for use of germplasm in breeding/ hybridization purposes by the private sector.
- Formulation of a harmonised germplasm conservation, exchange and utilization mechanism with direct benefits to member countries to rationalize funding support for COGENT-linked ICGs and NCGs.
- Utilization of generated technologies to modernize conservation approaches for germplasm exchange, preservation and diversity protection.
- Adopting a multi-country ICG approach for broader regional scope of collection and duplication to optimize germplasm exchange among member countries within and between regions.
- Ex-situ conservation efforts, income generating projects through intercropping and livestock integration must consider socio-cultural, economic, and agro-climatic conditions such as access to irrigation and land conversion issues among others. However, consideration of the suitability of the ICG activities is required to avoid jeopardizing genebanks' welfare.
- Accelerating upstream research supporting making CTC and cryopreservation protocols available in the near future for mass propagation and safe movement of germplasm and conservation stability. These are the solutions to the lingering problem of low productivity and production and closing the demand-supply gap. Replanting and planting program should be supported with available quality planting materials to meet increasing market demands and stimulate prospects for coconut-based products. Conservation and sharing of genetic resources for varietal improvement and breeding are critical for a prosperous coconut industry.
- Coconut germplasm conservation must consolidate globally to help strengthen food and nutrition security via profiling and utilization of varieties with superior genetic traits. Governments must take an active role in safeguarding coconut genetic resources.
- Host countries must offer robust and supportive declarations of intent to comply to the signed agreement in the coconut diversity conservation and use.
- A more comprehensive socioeconomic valorisation of coconut germplasm and evaluation of the impact from its exchange is needed. This will include assessing how countries and certain industries benefit from germplasm exchange (case study of veneer) and hybridization in support of national planting and replanting programs

Forging partnerships and collaboration

- COGENT partnerships should be expanded to include research, academic institutions and private companies through collaborative research that will increase the network's ambit.
- COGENTs collaboration with the private sector, research agencies and coconut farming smallholders should be institutionalised and harmonized within ICC policies. It is further recommended to encourage greater cross collaboration among ITAGs

and among member and genebank host countries. Along these lines, the ITAGs' framework for interactions and the Terms of Reference should be refined and ratified. With regards to private-sector engagement, adopting public-private partnerships is logically feasible. For planning and formulation of science-based strategies in support of germplasm conservation and exchange, engaging research institutions can create R & D alliances and establish networks and linkages.

- Adopting best practices from certain industries like coffee and cacao where stronger corporate social responsibility prevails at a global level will help strengthen COGENT. Key private-sector players can play a more active role in creating a vibrant R & D context and provide more effective support to small-scale farmers. Providing an attractive investment portfolio and technology pitching. will boost private-sector interest and engagement.

Sustainability and resource mobilization

- Technical support from ITAGs is of paramount importance, and the development of project proposals will sustain ITAGs momentum.
- Incentives must be established for ITAGs leadership and for contributory members in implementing scientific activities to support germplasm conservation, exchange and use. To cite an example, CTC technology as potential tool for safe germplasm movement and mass propagation of elite planting materials.
- The ITAG 3 biosecurity protocol should be finalised for more effective and safer germplasm exchange under ITPGRFA, with due consideration of the respective national biosecurity regulations. Standard, harmonized, and holistic biosecurity measures must comply with both national and international regulatory policies.
- ITAG and ICG succession plans must be designed and implemented that will guarantee the stability of the long-term activities and knowledge transfer through capacity building of junior staff as members of COGENT.
- An indicative investment portfolio must be developed to fully valorise germplasm conservation, exchange and use for enhancing private-sector engagement.
- A 5-year work program and investment plan to generate sustainable funding for ITAGs activities should be formulated through crafting the road map. Directions and ITAGs key priority areas must be identified by convening the ITAGs through virtual quarterly meetings. ITAGs' priority research shall be linked ICC program strategies.
    - ITAG1 to focus on ICG-related conservation management
    - ITAG 2 to consolidate genomics and breeding links;
    - ITAG 3 for biosecurity planning and conducting survey/ review of diagnostic tools and mapping for major pests and diseases; and
    - ITAG 4 links to all tissue culture and cryopreservation laboratories; mass propagation and germplasm preservation
- These priority areas will form the basis of renewed resource mobilization through proposal development. The ITAG members/team leaders shall contribute to developing COGENT Strategy Implementation Plan and Budget ITAG members/team leaders contribute to developing COGENT Strategy implementation plan & budget.
- Developing a mechanism to enhance active interaction and collaboration with the private sector and national agencies of the member countries will allow a broader

reach and scope of COGENT's germplasm conservation programme and recognition of its importance to the industry.

- Inclusion of a cross-cutting socio-economic theme that overarches the four ITAGs in the road map framework.
- Developing business plans for conserving and promoting economically-important germplasm will better respond to the industry's needs.

In order to sustain support to COGENT's initiatives and mobilization of resources:

(1) There is a need to realign COGENT's priorities into need/demand-based programming.
(2) As such, it is imperative to identify and overcome the roadblocks to germplasm exchange and utilization.
(3) The generation of program reports highlighting fair measures of objectively verifiable indicators offers an effective strategy for determining milestones and gaps and identifying key areas of support that may require funding for continuity, expansion or replication.
(4) Donor networks must be identified in parallel with an effective resource mobilization strategy.
(5) The adoption of suitable business models is needed for an improved investment portfolio.
(6) A participatory, consultative process among stakeholders will help promote sustained partnerships and support COGENT's initiatives.

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Alouw, J., Manohar, E., Kotekatte, M., Johnson V., Karun, A., Oropeza, A., Adkins, S., Panis, B., Cueto, C., and Nguyen Q.. (Editors). 2022. Unpublished. Proceedings of the ICC-COGENT 2nd international tissue culture and cryopreservation virtual symposium and workshop: A Virtual Symposium on coconut tissue culture technology with the theme "Coconut Tissue Culture Technologies: Aspects and Prospects" on 04-06 May 2022 and Physical Workshop on coconut tissue culture technology with the theme "Collaborative Initiatives towards Enhancing Tissue Culture Research and Development" on 16-20 *May 2022 ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala, 671 124, INDIA*

11. List of publications produced by project

COGENT NEWSLETTER VOLUME 1. JULY 2020. https://www.cogentnetwork.org/cogent-newsletter-vol-01--july-2020

COGENT NEWSLETTER VOLUME 1. 2021. https://www.cogentnetwork.org/cogent-newsletter-volume-02-2021

12. Appendices

Appendix 1: COGENT's Conceptual Framework of the Global Strategic Plan for Coconut Germplasm Conservation and Use

	2022	2023	2024	2025	2026	BEYOND
R&D Support	*Efficient Germplasm Exchange and Sustainability of ICG conservation of genetic resources*					
	Development of biosafety and germplasm exchange protocols					
	Tissue Culture (Clonal Propagation /Somatic Embryogenesis) and Embryo Cryopreservation					
Capacity Building and Promotion	*Conduct of trainings, attendance to conferences/symposia and technical meetings*					
	Publication of technical papers, newsletter, proceedings and documentation of technical meetings					
Program Proposal Development	*Linking Conservation, Distribution and Utilization of Genetic Resources responsive to the Industry needs*					
	Mass Propagation Scheme and Distribution of Genetic Resources of economic importance					
		Farmer-participatory conservation of indigenous populations				
Resource Mobilization and Management	*Develop income-generating scheme for sustainability of ICGs and NCGs*					
	Submission of project/program proposals to donor institutions and local funding support to NCGs					
Key Milestones	✓ Improved management of 5 ICGs and 19 NCGs ✓ Conserved the target accessions per year ✓ Updated the database management ✓ Developed improved varieties responsive to industry needs ✓ Trained ICG curators and staff on database management ✓ Utilized x number of genetic resources for breeding ✓ Engaged participation of junior researchers for succession plan			✓ Activated the ITAGs and addressed challenges of the R & D projects ✓ Reviewed Biosafety Protocols for germplasm movement ✓ Supported priority R & D projects of ITAGs ✓ Tissue Culture Workshop and Conference ✓ Webinars on CRB, CLY and IPM Symposium ✓ Proposals Submitted and Approved by donors ✓ Published technical papers and newsletters ✓ Secured governmental (ICG hosts) policies and support		

Appendix 2: Business Models for Coconut Technologies

COFFEE – COCONUT INTERCROPPING

PARTICULARS	Y1	Y2	Y3	Y4	Y5
A. COFFEE (500 trees per hectare)					
I. COST					
a. Materials	15,700.00	1,650.00	2,717.00	7,425.00	7,625.00
b. Labor	35,850.23	23,777.40	23,777.40	29,070.50	33,057.70
TOTAL COST OF PRODUCTION	**51,550.23**	**25,427.40**	**26,494.40**	**36,495.50**	**40,682.70**
II. YIELD AND INCOME					
a. Yield (green beans)		350.00	834.00	1,250.00	1,667.00
b. Gross Income (PhP 76.23/kg)		26,680.50	63,575.82	95,287.50	127,075.41
TOTAL GROSS INCOME	**0.00**	**26,680.50**	**63,575.82**	**95,287.50**	**127,075.41**
NET INCOME	**-51,550.23**	**1,253.10**	**37,081.42**	**58,792.00**	**86,392.71**
Return on Investment (ROI)		**5%**	**58%**	**62%**	**68%**
Benefit-Cost Ratio (BCR)		**1.05**	**2.40**	**2.61**	**3.12**
B. COCONUT					
I. COST					
a. Materials	**7,850.00**	**7,850.00**	**7,850.00**	**7,850.00**	**7,850.00**
- Ammonium Sulfate (AS)	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00
(1.5kg/tree x 100 Trees=150 kg @50 kg/bag = 3 bags PhP750/bag)					
- Potassium Chloride (KCl)	5,600.00	5,600.00	5,600.00	5,600.00	5,600.00
(2kg/tree x 100 Trees = 200 kg @ 50 kg/bag = 4 bags @ 1400/bag)					
b. Labor	**16,100.00**	**20,500.00**	**20,500.00**	**20,500.00**	**20,500.00**
- Fertilizer application (5 MD @ PhP 500/MD)	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
- Copra Production (harvesting, hauling, piling, dehusking, splitting, drying, scooping/slicing, bagging, hauling/transport) = 6,800 nuts x PhP 2.00/nut	13,600.00	18,000.00	18,000.00	18,000.00	18,000.00
TOTAL COST OF PRODUCTION	**23,950.00**	**28,350.00**	**28,350.00**	**28,350.00**	**28,350.00**
II. YIELD AND INCOME					
a. Nuts	6,800.00	9,000.00	9,000.00	9,000.00	9,000.00
b. Copra (4.5 nuts/kg)	1,500.00	2,000.00	2,000.00	2,000.00	2,000.00
c. Gross Income (Copra @ PhP 25/kg)	37,500.00	50,000.00	50,000.00	50,000.00	50,000.00
TOTAL GROSS INCOME	**37,500.00**	**50,000.00**	**50,000.00**	**50,000.00**	**50,000.00**
NET INCOME	**13,550.00**	**21,650.00**	**21,650.00**	**21,650.00**	**21,650.00**
ROI	**57%**	**76%**	**76%**	**76%**	**76%**
BCR	**1.57**	**1.76**	**1.76**	**1.76**	**1.76**
C. COCONUT + COFFEE					
a. Gross Income	**37,500.00**	**76,680.50**	**113,575.82**	**145,287.50**	**177,075.41**

PARTICULARS	Y1	Y2	Y3	Y4	Y5
- Coffee	0.00	26,680.50	63,575.82	95,287.50	127,075.41
- Coconut	37,500.00	50,000.00	50,000.00	50,000.00	50,000.00
b. Total Cost of Production	**75,500.23**	**53,777.40**	**54,844.40**	**64,845.50**	**69,032.70**
- Coffee	51,550.23	25,427.40	26,494.40	36,495.50	40,682.70
- Coconut	23,950.00	28,350.00	28,350.00	28,350.00	28,350.00
c.1. Net Income (PHP)	**-38,000.23**	**22,903.10**	**58,731.42**	**80,442.00**	**108,042.71**
c.2. Net Income (USD)	**-678.58**	**408.98**	**1,048.78**	**1,436.46**	**1,929.33**
d. ROI	**-101%**	**30%**	**52%**	**55%**	**61%**
e. BCR	**0.50**	**1.43**	**2.07**	**2.24**	**2.57**
ASSUMPTIONS: * Average Minimum Daily Wage based on the National Wages and Productivity Commission - Minimum Wage Rate for Agriculture - As of Dec. 2021 * Copra production was computed at 4.5 nut for every kilo of copra * Price of copra is constant (farmgate price) * Price of coffee is constant (farmgate price) * Price of fertilizers based on FPA Price Statistis * 1USD = 56PHP					

CACAO – COCONUT INTERCROPPING

PARTICULARS	Y1	Y2	Y3	Y4	Y5
A. CACAO					
I. COST					
a. Materials	15,700.00	3,700.00	7,150.00	7,550.00	7,950.00
b. Labor	11,150.00	9,075.00	17,875.00	22,000.00	27,500.00
TOTAL COST OF PRODUCTION	**26,850.00**	**12,775.00**	**25,025.00**	**29,550.00**	**35,450.00**
II. YIELD AND INCOME					
a. Yield (dry beans)		327.00	954.00	1,363.00	1,909.00
b. Gross Income (PhP 92.94/kg)		30,391.38	88,664.76	126,677.22	177,422.46
TOTAL GROSS INCOME		**30,391.38**	**88,664.76**	**126,677.22**	**177,422.46**
NET INCOME	**-26,850.00**	**17,616.38**	**63,639.76**	**97,127.22**	**141,972.46**
ROI		**138%**	**254%**	**329%**	**400%**
BCR	**0.00**	**2.38**	**3.54**	**4.29**	**5.00**
B. COCONUT					
I. COST					
a. Materials	**7,850.00**	**7,850.00**	**7,850.00**	**7,850.00**	**7,850.00**
- Ammonium Sulphate (AS)	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00
(1.5kg/tree x 100 Trees=150 kg @50 kg/bag = 3 bags PhP750/bag)					
- Potassium Chloride (KCl)	5,600.00	5,600.00	5,600.00	5,600.00	5,600.00

PARTICULARS	Y1	Y2	Y3	Y4	Y5
(2kg/tree x 100 Trees = 200 kg @ 50 kg/bag = 4 bags @ 1400/bag)					
b. Labor	**12,700.00**	**12,700.00**	**12,700.00**	**12,700.00**	**12,700.00**
- Fertilizer application (5 MD @ PhP 500/MD)	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
- Copra Production (harvesting, hauling, piling, dehusking, splitting, drying, scooping/slicing, bagging, hauling/transport) =6,800 nuts x PhP 1.50/nut	10,200.00	10,200.00	10,200.00	10,200.00	10,200.00
TOTAL COST OF PRODUCTION	**20,550.00**	**20,550.00**	**20,550.00**	**20,550.00**	**20,550.00**
II. YIELD AND INCOME					
a. Nuts	6,800.00	9,000.00	9,000.00	9,000.00	9,000.00
b. Copra (4.5 nuts/kg)	1,500.00	2,000.00	2,000.00	2,000.00	2,000.00
c. Gross Income (Copra @ PhP 20/kg)	30,000.00	40,000.00	40,000.00	40,000.00	40,000.00
TOTAL GROSS INCOME	**30,000.00**	**40,000.00**	**40,000.00**	**40,000.00**	**40,000.00**
NET INCOME	**13,975.00**	**21,775.00**	**21,775.00**	**21,775.00**	**21,775.00**
ROI	**68%**	**106%**	**106%**	**106%**	**106%**
BCR	**1.46**	**1.95**	**1.95**	**1.95**	**1.95**
C. COCONUT + CACAO					
a. Gross Income	**30,000.00**	**70,391.38**	**128,664.76**	**166,677.22**	**217,422.46**
- Cacao	0.00	30,391.38	88,664.76	126,677.22	177,422.46
- Coconut	30,000.00	40,000.00	40,000.00	40,000.00	40,000.00
b. Total Cost of Production	**47,400.00**	**33,325.00**	**45,575.00**	**50,100.00**	**56,000.00**
- Cacao	26,850.00	12,775.00	25,025.00	29,550.00	35,450.00
- Coconut	20,550.00	20,550.00	20,550.00	20,550.00	20,550.00
c.1. Net Income (PHP)	**-17,400.00**	**37,066.38**	**83,089.76**	**116,577.22**	**161,422.46**
c.2. Net Income (USD)	**(310.71)**	**661.90**	**1,483.75**	**2,081.74**	**2,882.54**
d. ROI	**-37%**	**111%**	**182%**	**233%**	**288%**
e. BCR	**0.63**	**2.11**	**2.82**	**3.33**	**3.88**

ASSUMPTIONS:
* Average Minimum Daily Wage based on the National Wages and Productivity Commission - Minimum Wage Rate for Agriculture - As of Dec. 2021
* Copra production was computed at 4.5 nut for every kilo of copra
* Price of copra is constant (farmgate price)
* Price of cacao is constant (farmgate price)
* Price of fertilizers based on FPA Price Statistics - as of Sept 2014 plus transport and warehousing cost
* 1 USD = 56 PHP

BANANA – COCONUT INTERCROPPING

PARTICULARS	Y1	Y2	Y3	Y4	Y5
A. BANANA (Saba/Cardava, 500 hills per hectare)					
I. COST					
a. Materials	13,100.00	10,600.00	10,600.00	10,600.00	10,600.00
b. Labor	19,550.00	7,475.00	7,475.00	7,475.00	7,475.00
TOTAL COST OF PRODUCTION	**32,650.00**	**18,075.00**	**18,075.00**	**18,075.00**	**18,075.00**
II. YIELD AND INCOME					
a. Yield (green beans)		12,000.00	12,000.00	12,000.00	12,000.00
b. Gross Income (PhP 70/kg)		99,000.00	99,000.00	99,000.00	99,000.00
TOTAL GROSS INCOME		**99,000.00**	**99,000.00**	**99,000.00**	**99,000.00**
NET INCOME	**-32,650.00**	**80,925.00**	**80,925.00**	**80,925.00**	**80,925.00**
ROI	**-100.00%**	**447.72%**	**447.72%**	**447.72%**	**447.72%**
BCR	**0.00**	**5.48**	**5.48**	**5.48**	**5.48**
B. COCONUT					
I. COST					
a. Materials	**7,850.00**	**7,850.00**	**7,850.00**	**7,850.00**	**7,850.00**
- Ammonium Sulfate (AS)	2,250.00	2,250.00	2,250.00	2,250.00	2,250.00
(1.5kg/tree x 100 Trees=150 kg @50 kg/bag = 3 bags PhP750/bag)					
- Potassium Chloride (KCl)	5,600.00	5,600.00	5,600.00	5,600.00	5,600.00
(2kg/tree x 100 Trees = 200 kg @ 50 kg/bag = 4 bags @ 1400/bag)					
b. Labor	**9,300.00**	**11,500.00**	**11,500.00**	**11,500.00**	**11,500.00**
- Fertilizer application (5 MD @ PhP 500/MD)	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
- Copra Production (harvesting, hauling, piling, dehusking, splitting,	6,800.00	9,000.00	9,000.00	9,000.00	9,000.00
drying, scooping/slicing, bagging, hauling/transport)					
= 6,800 nuts x PhP 1.00/nut					
TOTAL COST OF PRODUCTION	**17,150.00**	**19,350.00**	**19,350.00**	**19,350.00**	**19,350.00**
II. YIELD AND INCOME					

PARTICULARS	Y1	Y2	Y3	Y4	Y5
a. Nuts	6,800.00	9,000.00	9,000.00	9,000.00	9,000.00
b. Copra (4.5 nuts/kg)	1,500.00	2,000.00	2,000.00	2,000.00	2,000.00
c. Gross Income (Copra @ PhP 20/kg)	30,000.00	40,000.00	40,000.00	40,000.00	40,000.00
TOTAL GROSS INCOME	**30,000.00**	**40,000.00**	**40,000.00**	**40,000.00**	**40,000.00**
NET INCOME	**12,850.00**	**20,650.00**	**20,650.00**	**20,650.00**	**20,650.00**
ROI	**75%**	**107%**	**107%**	**107%**	**107%**
BCR	**1.75**	**2.07**	**2.07**	**2.07**	**2.07**
C. COCONUT + BANANA					
a. Gross Income	**30,000.00**	**139,000.00**	**139,000.00**	**139,000.00**	**139,000.00**
- Banana		99,000.00	99,000.00	99,000.00	99,000.00
- Coconut	30,000.00	40,000.00	40,000.00	40,000.00	40,000.00
b. Total Cost of Production	**48,675.00**	**68,950.00**	**36,300.00**	**36,300.00**	**36,300.00**
- Banana	32,650.00	50,725.00	18,075.00	18,075.00	18,075.00
- Coconut	16,025.00	18,225.00	18,225.00	18,225.00	18,225.00
c.1. Net Income (PHP)	**-18,675.00**	**70,050.00**	**102,700.00**	**102,700.00**	**102,700.00**
c.2. Net Income (USD)	**(333.48)**	**1,250.89**	**1,833.93**	**1,833.93**	**1,833.93**
d. ROI	**-38%**	**102%**	**283%**	**283%**	**283%**
e. BCR	**0.62**	**2.02**	**3.83**	**3.83**	**3.83**
ASSUMPTIONS:					
* Average Minimum Daily Wage based on the National Wages and Productivity Commission - Minimum Wage Rate for Agriculture - As of Dec. 2021					
* Copra production was computed at 4.5 nut for every kilo of copra					
* Price of copra is constant (farmgate price)					
* Price of banana is constant (farmgate price)					
* Price of fertilizers based on FPA Price Statistis - as of Sept 2014 plus transport and warehousing cost					

VIRGIN COCONUT OIL (VCO) + COCO FLOUR PROCESSIN

Item	Unit	Year 1	Year 2	Year 3	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5
		Quantity				Total Cost				
I. COST										
1. Nuts	kg	126,000	16,800	6,000	37.50	4,725,000.00	630,000.00	225,000.00	600,000.00	600,000.00
2. Labor (@P500.00/day Y1-3; 21 days per month)	MD	2,520	540	380	500.00	1,260,000.00	270,000.00	190,000.00	1,008,000.00	1,008,000.00
3. Machineries										
A. Grater	unit	1			13,000.00	13,000.00				
B. Air Compressor and Accessories	unit	2			10,000.00	20,000.00				
C. Stainless Storage Tanks with Accessories and sight glass	unit	1			120,000.00	120,000.00				
D. Continuous Pressure Filter	unit	1			70,000.00	70,000.00				
E. Drying Table	unit	1			22,000.00	22,000.00				
F. Pulverizing Table	unit	1			22,000.00	22,000.00				
G. Milk Presser	unit	1			200,000.00	200,000.00				
H. Filtration Set-up	unit	1			8,000.00					
I. Filtering Table	unit	1			24,000.00					24,000.00
J. Milk Extraction Table	unit	1			24,000.00					24,000.00
K. Packing Table	unit	1			24,000.00					24,000.00
L. Pallets	unit	4			2,800.00					11,200.00
M. Trolley	unit	1			12,000.00					12,000.00
TOTAL						**6,452,000.00**	**900,000.00**	**415,000.00**	**1,608,000.00**	**1,703,200.00**
II. REVENUE										
1. Revenue from VCO	litres	19,200	4,849	2,720	350.00	6,720,000.00	1,697,150.00	952,000.00	4,680,000.00	3,600,000.00
2. Revenue from Coco Flour	kg	4,800	1,212	680	35.00	168,000.00	42,428.75	23,800.00	8,125.00	6,250.00

Item	Unit	Year 1	Year 2	Year 3	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5
		Quantity				Total Cost				
TOTAL						6,888,000.00	1,739,578.75	975,800.00	4,688,125.00	3,606,250.00
TOTAL REVENUE						6,888,000.00	1,739,578.75	975,800.00	4,688,125.00	3,606,250.00
TOTAL COSTS						6,452,000.00	900,000.00	415,000.00	1,608,000.00	1,703,200.00
NET INCOME (PHP)						436,000.00	839,578.75	560,800.00	3,080,125.00	1,903,050.00
NET INCOME (USD)						7,785.71	14,992.48	10,014.29	55,002.23	33,983.04
ROI						6.76%	93.29%	135.13%	191.55%	111.73%
BCR						1.07	1.93	2.35	2.92	2.12
ASSUMPTIONS:										
* 1L VCO = 1kg VCO = 25g coco flour										
* 1USD = 56 PHP										

COCOSUGAR PROCESSING

Item	Unit	Year 3	Year 4	Year 5	Unit Cost	Year 3	Year 4	Year 5
		Quantity				Total Cost		
I. COST								
1. Coco sap	L	-	61,970	69,976	8.75	-	542,237.50	612,290.00
2. Labor	man-day	-	1,025	1,125	500.00	-	512,312.50	562,350.00
3. Machineries								
A. Moisture Analyzer	Unit	1				239,963.00		
B. Handheld Viscometer	Unit	1						
C. Handheld Brix Refractometer	Unit	5						
D. Handheld pH meter	Unit	18						
E. Candy Thermometer	Pc	9						
F. Knife	Pc	6						
TOTAL						239,963.00	1,054,550.00	1,174,640.00
II. REVENUE								
1. Coco sugar	Kg		7,746	8,747	180	-	1,394,325.00	1,574,460.00
TOTAL REVENUE						-	1,394,325.00	1,574,460.00
TOTAL COSTS						239,963.00	1,054,550.00	1,174,640.00
NET INCOME (PHP)						(239,963.00)	339,775.00	399,820.00
NET INCOME (USD)						(4,285.05)	6,067.41	7,139.64
ROI						-100.00%	32.22%	34.04%
BCR						0.00	1.32	1.34

ASSUMPTIONS:
*Production starts at y3
* Production Volume per month: 1.5 ton = 1,500 kg cocosugar
* 8L coco sap can produce 1L syrup = 1kg cocosugar
* 21 working days per month = 252 working days per year

COIR + COIR-BASED ORGANIC FERTILIZER PROCESSING

5,000 Husks Capacity per Day

Item	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5
		Quantity			Quantity			Total Cost			Total Cost	
I. COST												
1. Coconut Husks	pc	1,200,000	1,200,000	500,000	1,200,000	1,200,000	1.00	1,200,000.00	240,000.00	500,000.00	240,000.00	240,000.00
2. Labor (20 days)	MD	480	480	200	200	480	500.00	240,000.00	240,000.00	100,000.00	100,000.00	240,000.00
3. Machineries & Equipment												
Decorticating Machine	unit	1					370,000.00	370,000.00			-	
Sieving Machine	unit	1					57,387.00	57,387.00			-	
Twining Machines	unit	48					2,500.00	120,000.00			-	
Weaving Machines/loom	unit	4					3,000.00	12,000.00			-	
100 kl. Capacity weighing scale	unit	1					17,149.00	17,149.00			-	
Bag Closer	unit	1					17,205.00	17,205.00			-	
Shovel	unit	3					568.00	1,704.00			-	
Mixer	unit	1					50,000.00	50,000.00			-	
Empty Sacks	unit	1,000					13.39	13,387.00			-	
Bucket cart	unit	1					7,000.00	7,000.00			-	
Total								2,105,832.00	480,000.00	600,000.00	340,000.00	480,000.00
II. REVENUE												
1. Coconet	roll	360	600	250	360	240	2000.00	720,000.00	1,200,000.00	500,000.00	720,000.00	480,000.00
2. Cocopeat	sacks	2,400	2,400	4,800	2,400	2,400	70.00	168,000.00	168,000.00	336,000.00	168,000.00	168,000.00
3. Biologs	pc					1,920	120.00	-	-	-	-	230,400.00
Total								888,000.00	1,368,000.00	836,000.00	888,000.00	878,400.00
TOTAL REVENUE								888,000.00	1,368,000.00	836,000.00	888,000.00	878,400.00
TOTAL COSTS								2,105,832.00	480,000.00	600,000.00	340,000.00	480,000.00
Net Income (PHP)								-1,217,832.00	888,000.00	236,000.00	548,000.00	398,400.00
Net Income (USD)								-21,747.00	15,857.14	4,214.29	9,785.71	7,114.29
ROI								-58%	185%	39%	161%	83%
BCR								0.42	2.85	1.39	2.61	1.83

ASSUMPTIONS:
* Coconut husks Price @ 1PHP
* Days of Operation = 20 days per month

SUMMARY FINANCIAL ANALYSIS OF DIFFERENT COCONUT TECHNOLOGIES

Coconut Technology	Average Total Cost (USD)	Average Total Revenue (USD)	Average Net Income (USD)	Average Return on Investment	Average Benefit-Cost Ratio
Coffee-Coconut Intercropping	1,135.72	1,964.71	829	76%	1.76
Cacao-Coconut Intercropping	830.00	2,189.84	1,359.84	1.56	2.56
Banana-Coconut Intercropping	809.02	2,092.86	1,283.84	1.82	2.82
VCO – Coco Flour	39,565.00	63,920.55	24,355.55	1.08	2.08
Coconut Sugar	14,697.34	17,671.34	2,974.00	(0.11)	0.89
Coir	14,306.54	17,351.43	3,044.89	0.82	1.82

Appendix 3: Proceedings of the ICC-COGENT 2nd International Tissue Culture and Cryopreservation Virtual Symposium and Workshop

PROCEEDINGS OF THE ICC-COGENT 2ND INTERNATIONAL TISSUE CULTURE AND CRYOPRESERVATION VIRTUAL SYMPOSIUM AND WORKSHOP

On behalf of ICC-COGENT

COGENT's International Thematic Action Group for Tissue Culture & Cryopreservation (ITAG 4)
presents
Virtual Symposium on coconut tissue culture technology with the theme "Coconut Tissue Culture Technologies: Aspects and Prospects" on 04-06 May 2022
and

Physical Workshop on coconut tissue culture technology with the theme "Collaborative Initiatives towards Enhancing Tissue Culture Research and Development" on 16-20 May 2022 ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala, 671 124, INDIA

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COCONUT TISSUE CULTURE

The economic importance of coconut is undeniably of global interest. It's varied uses and the direct and indirect dependence of millions of people in this crop has proven its significance especially in the vegetable oil world market. It has been reported by ICC that coconut is being cultivated in 12 million hectares of land in tropical and subtropical areas of the globe. Moreover, 34 varieties of trees in the world are being tried to be conserved and prospected by COGENT for biodiversity protection and selection of germplasm with especial traits to produce products with increasing market demand such as coconut sap sugar, high lauric acid for Virgin Coconut Oil and oleochemicals.

However, despite its resiliency and diverse applications of every part of the crop, challenges must be addressed. Declining productivity is a pressing problem for decades is affected by senility as the trees reached 40 years of age, nut yield is less. Other factors that affect the productivity are unforeseen calamities such as storms, cyclones, and tsunamis; and the depleting nutritional conditions of the soil and the damages caused by pest and diseases. These are major concerns on increasing productivity from an average of 60 nuts per tree per year to at least 120-150 nuts per tree per year. Planting of precocious varieties and hybrids must be implemented, but the need for mass propagation of quality planting materials and hybridization program to address the lingering problem of low productivity.

Unfortunately, this crop cannot be propagated through vegetative methods. Currently, the conventional or traditional means of propagating the coconuts is by using seeds. But with this propagation, competing with the supply of nuts to meet the market demands is a challenge especially for the massive planting and replanting programs of the major coconut producing countries. Moreover, breeding coconuts in the traditional method including regenerations for coconut improvement is unlikely to be an appropriate solution to increase productivity. But with the advent of modernization, biotechnology is an option to propagate this crop. Massive propagation and true-to-type reproduction can be realized by using tissue culture techniques.

These modern techniques offer logical solutions to mass propagation and conservation of coconuts through embryo culture, somatic embryogenesis and cryopreservation, respectively. Tissue culture is one of the promising alternatives to complement the available technologies on mass production of coconuts. Many high value coconut varieties have been developed and found suitable for the development of various high value coconut products and for massive growing in different countries in the tropics. The availability of these planting materials for commercial utilization and development has been limited due to low seed multiplication rate (one nut of one embryo is to one seedling), The requirement for large areas and the long period of time to establish seed gardens and the absence of a reliable mass propagation protocol are major challenges in the planting and replanting program to increase productivity.

The embryo culture protocol, as the most basic tissue culture technique was developed for mass production, embryo rescue and transfer of coconut. This enabled research and development of new hybrids and expansion of the genetic base of the different coconut growing countries. For somatic embryogenesis, plumule and ovary as explants were also found to be responsive in culture. In the case of the protocol using ovary, this needs further verification for it to be adopted commercially. The use of immature inflorescence and meristem shoots for direct organogenesis allows the enormous production of coconut plantlets without undergoing somatic embryogenesis, thereby, limiting the prolonged exposure of the tissues and plantlets to high concentrations of 2,4-D are limiting factors of the technology. The available coconut tissue protocols need to be optimized to come up with a standardized protocol that would be available for use of the different coconut tissue culture laboratories. In terms of cryopreservation, except for use of pollen which wherein cryopreserved pollen is being used for commercial production of coconut hybrids. As such, standard protocols with optimum results must be developed to have available cryopreserved-derived plantlets for field planting. The presented acclimatization protocols likewise require verification and standardization to improve and ensure successful ex vitro establishment of the seedlings for field planting. Moreover, the field performance of these plantlets derived from using various protocols must be ascertained. In whatever protocol used, the successful ex vitro establishment of the tissue culture-derived seedlings is the ultimate measure of success of an in vitro protocol.

Like any other research undertakings, the coconut tissue culture protocol development was expected to be sluggish due to challenges and limitations. The following reasons are the following:

- Diverse varietal responses of coconut tissues
- In vitro culture explants have long gestation period due to slow growth
- Acclimatization of the ex-vitro explants has to be optimized to have a standard protocol.

But, despite these challenges encountered and the iterative attempts of most coconut tissue culture laboratories, continuous studies were undertaken. So far, there have been promising results generated especially in the specific areas of a) embryo culture, b) somatic embryogenesis, c) homozygote production via anther culture, d) immature ovary e) germplasm conservation using cryopreservation method.

With such developments, the quest for novel research outputs synergy among the experts was made possible through the conduct of interactive mind setting and sharing of experiences. The conduct of the virtual symposium and workshop paved the way to unified goal setting in the field of tissue culture and cryopreservation. In addition, a roundtable discussion with the key industry players served as the prelude to harmonizing the needs and the directions of the coconut tissue culture research and development aligned to the industry demands. The training provided the junior coconut tissue culturists with the state- of the art protocols for embryo culture and exchange, mass propagation, cryopreservation and acclimatization of coconuts. Aside from the technical challenges, resources and provision of funding support to the coconut tissue culture laboratories are the lingering drawbacks. Regular workshops and monitoring of the progress of the tissue culture activities in the participating different laboratories and hands-on trainings for the participants need to be organized so ensure that all partners are towards achieving the same level of competence. A network must be established to facilitate monitoring and continuous exchange of information and experiences.

These events were made possible through the combined efforts of ICC, COGENT and ACIAR who initiated and made it to its success level. In addition, the sponsorship and DOST-PCAARRD and Chemrez, Philippines, the 2nd Virtual International Symposium provided the platform for establishing the state of the art and prospects of the Coconut Tissue Culture geared towards addressing the needs of the industry and accelerating the scientific modernization in the coconut R and D program.

The International Coconut Community (ICC)

The International Coconut Community (ICC) is an intergovernmental organization of coconut producing countries organized in 1969 under the aegis of the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP). The ICC Secretariat is in Jakarta, Indonesia and is headed by an Executive Director. Its mandate is to promote, coordinate and harmonize all activities of the coconut industry with a view to achieving maximum economic development of the industry through better production, processing, marketing, and research. ICC currently has 20 coconut producing member countries accounting for over 90 percent of world coconut production and exports of coconut products.

The ICC member countries include eight Asian countries: India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand, Vietnam and Timor Leste, nine Pacific countries: Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu, one Caribbean country: Jamaica, one African country: Kenya and one country in South America: Guyana. Membership to the Community is open to all coconut producing countries, with the unanimous consent of the existing members and by acceding to the agreement establishing the Coconut Community.

International Coconut Genetic Resources Network (COGENT)

The International Coconut Genetic Resources Network (COGENT) with 39 coconut growing countries as members was established by the International Plant Genetic Resources Institute (IPGRI- now Bioversity International). COGENT has the mandate for coordinating efforts to conserve and utilize coconut genetic resources. However, international support for COGENT is flagging. This project aims to support revitalizing COGENT, achieve an orderly transition of COGENT's Secretariat from Bioversity International to the Jakarta-based International Coconut Community (ICC), and ensure technical support for the implementation of the recently formulated Global Strategy for Conservation and Use of Coconut Genetic Resources. This transfer is made more appropriate by the conversion of the Asian and Pacific Coconut Community (APCC) into the International Coconut Community with an expanded mandate to promote the global development of the coconut, which transformed status is endorsed by the United Nations. It aims to promote collaboration for the conservation and use of coconut genetic resources. COGENT currently is made up of 39 country members. COGENT has established four International Thematic Action Groups (ITAGs) to lead in the identification and coordination of priority projects for germplasm conservation and use, linked to implementing COGENT's Global Strategy for the Conservation and Use of Coconut Genetic Resources.

Australian Centre for International Agricultural Research (ACIAR)

Since 1982, ACIAR has brokered international research partnerships to help address agricultural challenges in the Indo-Pacific region. ACIAR has made significant contribution to improving the livelihoods of small holder farmers fishers and foresters by deploying Australia's considerable skills and expertise. ACIAR supports Australia's national interests by contributing to sustainable economic growth and enhanced regional stability, with a particular focus on economic diplomacy and women's economic empowerment. Its works are aligned closely with Australia's broader development assistance program, supporting research collaboration while emphasizing individual and institutional capacity building and private sector-led development, targeted at improved livelihoods in agriculture, forestry and fisheries. The collaborative international programs and partnerships underpinning ACIAR-supported research also serve to improve Australian scientific capabilities and the productivity and sustainability of agricultural systems in Australia.

ACIAR-Funded Project: Supporting an International Initiative to Maintain the Coconut Genetic Resources Network (COGENT)

This project aims to support transitional arrangements for passing on the hosting of the COGENT program from Bioversity International to ICC and establishing COGENT on a sustainable basis. Five international coconut collections (international coconut genebanks (ICGs)) have been established in Brazil, Côte d'Ivoire, India, Indonesia, and Papua New Guinea. These and many of the 19 national coconut collections are poorly conserved and suffering from genetic erosion. Several collecting and conservation activities have been initiated by coconut growing countries, but these activities are neither coordinated nor harmonized, resulting in inadequate germplasm conservation and evaluation and inefficient germplasm utilization.

This project expects the following outcomes:

- Achieving an orderly transfer of the COGENT Secretariat from Bioversity to ICC.
- Establishing the foundation and providing technical support for the initial implementation of the Global Strategy for Conservation and Use of Coconut Genetic Resources.
- Conducting individual appraisals of the five ICGs and providing initial support for the long-term conservation and evaluation of the conserved germplasm and integration of the collected data into the COGENT database.
- Fostering income-generating components and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

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THE ROUNDTABLE DISCUSSION WITH THE PRIVATE SECTOR

A virtual roundtable discussion on the coconut tissue culture aspects and prospects was conducted on 27 April 2022 as a pre-symposium activity. Various companies from the private sector were invited in the discussion. This was initiated and conceptualized by ICC-COGENT Secretariat to evoke the interest the of the private sector on the importance of conservation of and use of the coconut genetic resources in the industry development. It was emphasized in this event the vital role of the tissue culture and cryoconservation technologies as the key determinants of accelerating mass propagation and varietal improvement. These are the way forward to address the challenges of productivity and addressing supply-demand gap of the industry. Thus, private sector plays an important role as major partner in achieving sustainability and prosperity of the industry.

PROGRAM

Figure 1. RTD Program

OBJECTIVES OF THE ROUNDTABLE DISCUSSION

1. To have an interactive virtual platform in harmonizing the science-based networks of CTC technology and updating the potential users
2. To create a unified perceptions, expectations and areas of collaborations to address challenges, gaps and needs of CTC technology for commercialization.
3. To enhance synergy and partnership among industry stakeholders by sharing and adopting the CTC outputs and breakthroughs.
4. To engage private sectors in the promotion and funding of CTC technology Research & Development program.

EXPECTED OUTPUTS

1. Unified perceptions, expectations and areas of collaborations with industry stakeholders from the CTC research, development and innovations
2. Identified the challenges, gaps, needs and opportunities from CTC with reference to the needs of the coconut industry stakeholders for technology commercialization
3. Enhanced partnership and synergy among industry stakeholders thru sharing and application of the coconut tissue culture technology
4. Potential funding support for research, development and innovation platform of coconut tissue culture.
5. Promotion of the tissue culture research and development program to policy makers and funding institutions

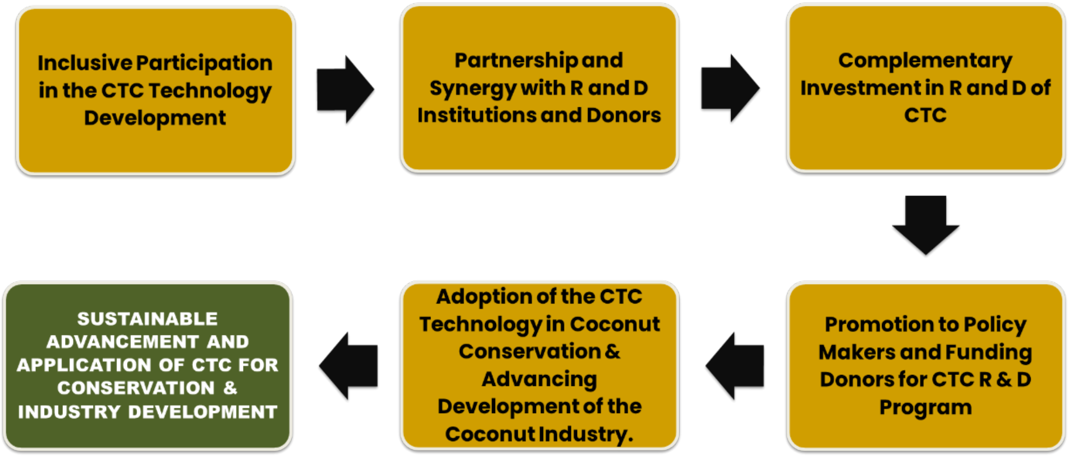
ASPECTS OF COCONUT TISSUE CULTURE: STATE OF THE ART

1. Updates of the Coconut Tissue Culture Technology
2. Proof of Concept of Coconut Tissue Culture Technology
3. Status of the Coconut Tissue Culture R & D
4. Challenges, Gaps, Needs and Application of Coconut Tissue Culture Technology
5. Expected Outputs and Outcome
6. Projected Investments for Upscaling and Innovations (Budget and Time)

PROSPECTS OF COCONUT TISSUE CULTURE: SOCIOECONOMIC IMPACT

1. Proof of Evidence of the CTC Technology
2. Agribusiness Prospects of the CTC Technology
3. Opportunities and Risks of the CTC Technology
4. Projected Socioeconomic Feasibility of CTC Technology
5. Private Sector Support and Participation in the CTC R & D program

KEY AREAS OF COLLABORATION WITH THE PRIVATE SECTOR



TEN-POINT AGENDA DISCUSSED DURING THE ROUND TABLE DISCUSSION

1. What are the perceived coconut industry needs for Coconut Tissue Culture Technology (CTC)?
2. What particular varietal profiles, in terms of agronomic performance and quality, need promotion for application of CTC?
3. What are the mechanisms in enhancing partnership with companies and their willingness to invest in the coconut tissue culture R & D and how much are they willing to co-share for investment?
4. What are the priority concerns of the coconut tissue culture based on its current status and expected timelines?
5. What is the economic value of tissue culture in the coconut industry? What is the evidence of that value that will guarantee benefits from the investment?
6. What are the coconut industry priorities for hybridization and mass propagation using the CTC technology?
7. What are the opportunities and risks of the public-private collaboration on CTC technology towards commercialization?
8. What will be the mechanism to be adopted in accessing CTC technologies developed or upscaled with the investment of private sector?
9. What markets will be best served by optimizing coconut CTC protocols, and making these available for mass propagation, with reference to products, varieties and regions?
10. What is the projected global demand for quality planting materials for national planting and replanting programs?

THE SYNTHESIS OF THE ROUND TABLE DISCUSSION

WHERE ARE WE NOW IN THE COCONUT TISSUE CULTURE RESEARCH AND DEVELOPMENT

Historically, the CTC technology attempts started in 1984-1990 as the earliest report of its possibility. In 1990-1995 coconut zygotic embryo culture for germplasm exchange was initiated and in 1995-2020 plumule culture and another culture were utilized for upstream research. The use of unfertilized ovary culture embryonic shoot meristem culture/cell suspension culture was reported in 1998-2010 Tissue culture protocol for large inflorescence and immature inflorescence; axillary shoot formation was developed from 2015-2021.

The sluggish evolution of Coconut Tissue Culture (CTC) protocols and bottlenecks as presented during the RTD is drives our efforts to pursue convergence and partnerships with coconut industry stakeholders. The presented state of the art of CTC research and development emphasizes a crucial need to accelerate and address the challenges to benefit from this technology. Strong support is needed to exploit the vast opportunities and prospects offered by CTC technology. The role of the private sector is critical, and their perceived CTC needs are of major consideration. In achieving higher coconut yields and quality through providing better planting material, ICC can meet a major objective of more than tripling nut production from 30 nuts to 100 nuts/palm/year. This will help reduce poverty to generate sustained cashflow from the 67 billion coconuts produced globally. The need to make a step change in plating material production, especially with hybrid production adopting CTC.

CHALLENGES AND OPPORTUNITIES FOR THE ADVANCEMENT OF THE COCONUT TISSUE CULTURE TECHNOLOGY

Generally, the aspects of CTC as reported by Dr Anitha Karun of CPCRI enumerated the identified bottlenecks of the technology a) Prolonged callus induction phase b) Formation of non-embryogenic calli c) Somatic embryos developing to plantlet is relatively meagre d) High heterozygosity among palms influencing the TC response o Physiological maturity of the explant influence TC response e) Activated charcoal - uncontrolled adsorption of nutrients of medium f) Acclimatization of regenerated plants.

In general, major challenges in the current status of CTC technology development as mentioned are the following:

1. Lack of fully developed and tested in vitro regeneration protocol
2. Insufficient exchange of information between active groups involved in coconut tissue culture
3. Insufficient funds especially for hiring manpower and acquiring infrastructure
4. Lack of problem-solving capabilities
5. Insufficient basic studies that decipher the physiological, biochemical, and molecular mechanism during in-vitro regeneration

In the case of using immature inflorescence, a major bottleneck is the explant collection wherein the mother palm is being sacrificed. The technique of collecting immature inflorescence without sacrificing mother need to be developed. Further, the long period of maintenance under dark condition and rooting was found to be very difficult Technique need to be further standardized. Common to all laboratories is the latent bacterial infection in cultures due long incubation. Techniques for management of microbial contamination in cultures need to be developed

As reported by Dr Oropeza of CICY, Mexico, with the CTC Technology, promising coconut germplasm can be rapidly and cost-effectively cloned to produce tens or hundreds of thousands of plantlets per year at a single facility, depending on the size of facility. Selected varieties of coconuts can increase competitiveness to include selection factors such as high yielding, disease resistance, etc. The cost of production will vary and especially be more costly than ‘traditional’ planting materials. He also noted the current price of in vitro coconut plantlets in Mexico as 6 USD before acclimatization, compared to other ready-for-planting plantlets, at between 7 USD for (MYD x Mexican Pacific Tall) hybrid and 11 USD for selected varieties (BGD). Coconut plantlet prices are as high as 20 USD in some markets. Given the status in vitro plantlet production, R&D could lead to improved efficiency and reduced production costs and convergence among the COGENT-ITAG4 research institutions and others. This could drive further improvement and optimization of CTC mass propagation production capacity of quality planting materials that could then be provided to coconut farmers at an affordable cost.

Given the challenges and prospects of the CTC as exemplified by CICY, Mexico, experiences of other laboratories in Philippines, India, Sri Lanka, Indonesia and Belgium, opportunities are there which can be explored thru collaboration and technology sharing. Applying CTC technology will boost mass propagation of quality and disease-free planting materials and result in more effective germplasm exchange and varietal improvement. However, there are priorities that should be addressed with provisions of support and consideration, thus, unified efforts are necessary to handle CTC bottlenecks in moving forwards. There were three primary concerns mention in the RTD in terms of i) the time needed to apply the protocols so we need to improve the efficiency of the protocols that will require funds; ii) addressing the acclimatization challenges that we've encountered, and iii) to finalize the proofs of concept for the different protocols and address issues caused by the occurrence of soma-clonal variation of the CTC technology.

In the report of Dr Karun obtaining friable callus and determining the embryogenic cells to initiate suspension culture are priority needs. It is also stressed to have uniform responses from the selected explants and reducing the time span from initial inoculation to plantlet regeneration must be studied. Common to all laboratories is the need to improving the survival rate of the plantlet during the acclimatization stage. These concerns can be addressed through exchange of information and provision of sufficient funds, available trained manpower.

EXPECTATIONS AND ADVANTAGES OF CTC PROTOCOLS DEVELOPED

As suggested in the RTD there is a need to ensure the supply of the correct germplasm for the industry and this can be achieved through developing a platform for collaboration where stakeholders develop relevant proposals together. A representative from private sector, an oleo-chemical manufacturer expressed his willingness to work together. Accordingly, across the value chain, one of the challenges of the company is that there's a gap between what they do and what decisions are made within research and development which includes the following such as

- Obtaining friable callus
- Determining the embryogenic cells to initiate suspension culture
- Obtaining uniform responses from the selected explants
- Reducing the time span from initial inoculation to plantlet regeneration
- Improving the survival rate of the plantlet during the acclimatization stage
- Exchange of information
- Sufficient funds
- Availability of trained manpower
- Common discussion platform for obtaining a meaningful solution for the practical difficulties arising during coconut tissue culture

In the Philippines the Coconut Somatic Embryogenesis Technology (CSEt) protocol is a breakthrough in biotechnology after 30 years. With the current success rate and under ideal situation, 3000 regenerants per responsive plumule could be attained in the laboratory Mass propagation thru CSEt is a must for efficient plantlet production with one plumule from one nut which could lessen the utilization of nuts as planting materials. This could maximize the utilization of the nuts as source of raw materials for food and non-food product. Further R & D to enhance the CSEt protocol is the key to crop improvement via transformation protocol using CRISPR as an advance tool in breeding technique.

PROSPECTS OF CTC AS AN AGRIBUSINESS VENTURE

Economic feasibility studies on the efficiency and effectiveness CTC protocols will help in reducing the cost of CTC plantlets. Further research in increasing the efficiency of protocol can also reduce the price of CTC plantlets and make them affordable to the coconut farmers. David Lobo of Deejay Farms suggested that they would like to tie up with government and research institutions and articulated the need to explain the value of the higher-priced plantlet material in terms of what they can generate in terms of added value for farmers. Micro-credit schemes could be developed so that small farmers who can't afford higher-priced planting material can pay for it later once they have developed the income from their increased productivity. CTC protocols need more time, so it's difficult to get below a certain unit-cost threshold– bananas for example are cheaper to produce because the protocols are more rapid but it's important also to consider that the cost of hybridization is dramatically reduced using tissue culture protocol.

In adopting and accessing CTC technologies developed or upscaled with the investment of the private sector, there must have a clear mechanism to jointly benefit from this research generated outputs. It is a rule of thumb in R & D that technologies are protected by patenting, but the optimization of these technologies could be done collaboratively and develop flexible patenting to protect the technology. The need to guarantee quality control and ensure that benefits can be shared amongst the participants. There is need to view tissue culture initiatives and protocols in the context of its value in the whole scope of coconut programs. Government collaboration can speed up development of tissue culture protocols and we can build on the existing infrastructure, however in cases where there is political instability which constrain government facilities the private sector could help to stabilize CTC via a collaborative, comprehensive and inclusive R & D program

MECHANISMS AND KEY AREAS OF PUBLIC-PRIVATE PARTNERSHIP

Public-Private initiatives can help to reduce risks and facilitate CTC implementation by bringing expertise on board in building a better programme. Risks of investment in CTC research are capital intensiveness and the lack of fully-developed protocols. Thus, perfecting CTC technology will involve more time and more studies and the involvement of various sectors to harmonize outcomes. It is necessary to adopt a mechanism of collaboration through convergence and mutual agreements between the research institutions and the private companies that can be facilitated by ICC and COGENT. However, there should be a network to oversee the execution and COGENT can play this key role as a network for conservation and use of the genetic resources. CTC is the tool in germplasm exchange and mass propagation of quality planting materials sorely needed by the industry to address the current supply-demand gap.

SOCIO-ECONOMIC IMPACTS TO THE COCONUT INDUSTRY

The industry needs to produce genetically uniform material for many different users and should be provided with facilities for technology transfer. David Lobo provided an example of how their NGO foundation helps small farmers by providing discounted seedlings and affirmed that tissue culture is the best way to grow the numbers or scale up the socioeconomic advantages of this technology are dramatic and will increase impacts. He also suggested that with the 12 million hectares 67 billion nuts per year of production where 50% are planted with senile trees, the actual requirement of 900 million nuts. The need to ensure also strong-rooting, high performing varieties even where typhoons and other stresses prevail. Given the vast numbers of senile palms, the demand for good planting material is enormous. There is also a need to diversify in terms of varieties which can provide high-value products such as biofuels, coco sugar and VCO. Hence, CTC protocols will be useful in selecting the best material for breeding, planting and replanting programs. David Lobo also asserted that the demand figures for planting materials globally is vastly underestimated which could be 42% instead of 21%.

PRIORITY RESEARCH & DEVELOPMENT AND KEY AREAS OF COLLABORATION & EXPECTED OUTCOMES

1. Optimization of the various processes to reduce costs of production
2. Cryopreservation of embryogenic callus (EC) to reduce labour and conserve Embryo Culture lines to reduce risk of somaclonal variation.
3. Germplasm exchange through the alternative in-vitro cultures (i.e., embryogenic call, shoots)
4. Genetic improvement with reference to pest and disease resistance and other biotic and abiotic stresses, collaborating with countries with such problems (e.g., Jamaica and Brazil)
5. Research on the development of resistance markers

Given such priority areas of R & D, private-sector and government support are vital in accelerating CTC strategic plans. The use of science-based tools should address the needs of the industry, and the need to increase production and use of genetic resources to produce quality planting materials with special traits. As such, key areas of collaboration with private sectors are as follows:

Progress is needed to optimize and implement the long-duration development of CTC technology. Huge investments and long gestation commitment of experts must be considered, and co-partnership with the private sector and governments will lead us to enhancing the value of CTC to the coconut industry. This is the jump start of bilateral and multilateral agreements if we are UNITED.

U – nified key players with common understanding of CTC technology

N - eeds and gaps identified to be addressed towards CTC success

I - ntegrated ideas, resources and skills shared and enhanced

T - issue culture technology aspects and prospects disclosed

E - ngaged everyone to be involved in moving forward to achieve success

D - irection setting towards a comprehensive and participatory R and D for CTC

WAY FORWARD AND FUTURE PLANS

1. Priority plans to consider the application of CTC for varietal profiles with reference to the needed quality traits to produce high-value products such as high lauric content, sugar content of coconut sap with low glycaemic index and thick meat for quality Desiccated Coconut.

2. Conduct of researches to accelerate and standardize the CTC protocols for utilization as agreed in the CTC and cryopreservation workshop such as ; genomics , optimization of CTC available protocols for multiplication capacity, acclimatization studies, field evaluation of the developed CTC protocols, somaclonal variation screening and assessment of varietal responses to CTC. Further, the need to conduct Feasibility Study for long term use of the industry of the genetic resources. These priority researches require investment for implementation to effectively support germplasm exchange for coconut genetic resources conservation and use.

3. Optimization and upscaling available CTC protocols as a tool in varietal improvement for mass propagation and to consider in breeding for pest tolerance and disease resistance that will facilitate germplasm exchange, including for more efficient hybrid mass-production

2ND INTERNATIONAL COCONUT TISSUE CULTURE SYMPOSIUM

PROGRAM

Date	Min	Theme	Presenter	Affiliation
	INAUGURAL SESSION			
Wednesday 04-May	5	Welcome address	Dr. Jelfina Alouw ICC Executive Director	International Coconut Community (ICC), Indonesia
	5	Opening Remarks	Mr. Benjamin Madrigal, Jr., Chairperson	ICC – Technical Working Group (TWG)
	5	ACIAR project and expectations from coconut TC programme	Ms. Irene Kernot, Research Program Manager-Horticulture	Australian Centre for International Agricultural Research, Australia (ACIAR)
			Dr. Tristan Armstrong, Agriculture Sector Specialist Private Sector	Department of Foreign Affairs and Trade (DFAT), Australia
	5	Tissue Culture Symposium Rationale, Objectives/Introduction	Ms. Erlene Manohar, COGENT Coordinator	International Coconut Genetic Resources Network (COGENT)
	5	**SESSION 1: THE STATE OF THE ART AND CHALLENGES OF COCONUT TISSUE CULTURE GLOBALLY** **Session Chairperson: Ms. Irene Kernot, *Research Program Manager-Horticulture*, ACIAR**		
	15	Coconut tissue culture: State of the art & global challenges	Dr. Anitha Karun, Director and ITAG 4 Leader	ICAR-Central Plantation Crops Research Institute, India
	15	Embryo culture and transfer	Dr. Steve Adkins, Professor / Researcher	University of Queensland, Australia
			Dr. Kristi Cueto, Tissue Culture Programme Leader	Philippine Coconut Authority, Philippines
	20	Coconut somatic embryogenesis and micropropagation technology development	Dr. Carlos Oropeza, Senior Researcher	Centro de Investigación Científica de Yucatán, Mexico
	15	Coconut somatic embryogenesis- Unfertilized ovary	Dr. Vijitha Vidhanaarachchi, Head, TC Division	Coconut Research Institute, Sri Lanka
	15	Micropropagation using axillary shoots	Dr. Bart Panis, Senior Researcher	Alliance of Bioversity International and CIAT, Belgium
	15	Acclimatization for ex vitro survival and development	Dr. Quang Nguyen, Scientist	The University of Queensland & International University, Vietnam

Date	Min	Theme	Presenter	Affiliation
				National University-HCM
	10	*Question and Answer*		
	5	***Tea/Coffee Break***		
	5	**SESSION 2: COCONUT GERMPLASM CRYOPRESERVATION** **Session Chairperson: Dr. Lalith Perera, *Additional Director*, Coconut Research Institute**		
	20	Cryopreservation protocols for shoot-tip cultures	Dr. Bart Panis, Senior Researcher	Alliance of Bioversity International and CIAT, Belgium
	15	Cryopreservation protocols for coconut zygotic embryos	Dr. Steve Adkins, Professor / Researcher	University of Queensland, Australia
	15	Cryopreservation protocols using coconut embryogenic callus	Dr. Gabriela Sandoval, Researcher	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, Mexico
	10	Cryopreservation protocol for coconut pollen	Dr. Anitha Karun, Director and ITAG 4 Leader	ICAR-Central Plantation Crops Research Institute, India
	10	*Question and Answer*		
	15	**PANEL DISCUSSION**	Ms. Erlene Manohar & Mr. Vincent Johnson, COGENT Coordinators	International Coconut Community-International Coconut Genetic Resources Network, Indonesia
		End of Day 1		
Thursday 05-May	5	**SESSION 3: SELECTION OF COCONUT GERMPLASM FOR IN VITRO CULTURE** **Session Chairperson: Dr. Carmel Pilotti, *Associate Scientist, Coconut Genetic Resources, Pacific Community* (SPC)**		
	15	Genotype selection for cloning, yield & other characteristics for different countries.	Mr. Ramon Rivera, Deputy Administrator	Philippine Coconut Authority, Philippines
	10	Field screening for LY/ other phytoplasma resistance / susceptibility	Dr. Egya Ndede Yankey, Senior Researcher	Oil Palm Research Institute, Ghana
			Dr. Wayne Myrie Plant Pathologist and ITAG 3 Leader	Coconut Industry Board, Jamaica
	10	Molecular Screening for resistance/susceptibility to major coconut insect pests and pathogens	Dr. Jimmy Botella, Professor Dr. Andrea Garavito, Senior Researcher	University of Queensland, Australia

Date	Min	Theme	Presenter	Affiliation
				Centre de coopération internationale en recherche, France
	10	*Question and Answer*		
	5	**SESSION 4: TISSUE CULTURE AND COCONUT GERMPLASM EXCHANGE** **Session Chairperson: Dr. Anitha Karun, *Director*, ICAR-CPCRI**		
	15	Germplasm exchange through alternative cultures (EC callus, vitro-shoots/plants).	Dr. Carlos Oropeza, Senior Researcher	Centro de Investigación Científica de Yucatán, Mexico
	15	Risks of transferring pathogens through germplasm exchange.	Dr. Vinayaka Hegde, Principal Scientist and Head Crop Protection	ICAR-Central Plantation Crops Research Institute, India
	10	*Question and Answer*		
	5	***Tea/Coffee Break***		
	5	**SESSION 5: BASIC STUDIES ON EMBRYOGENESIS TOWARDS ITS OPTIMIZATION** **Session Chairperson: Dr. Carlos Oropeza, *Senior Researcher*, CICY**		
	15	Gene expression analysis during coconut TC i.e., somatic embryogenesis	Dr. Rajesh M.K., Principal Scientist Dr. Luis Sáenz, Senior Researcher	ICAR-Central Plantation Crops Research Institute, India & Centro de Investigación Científica de Yucatán, Mexico
	15	Develop screening methods to detect somaclonal variation; Genetic stability of embryogenic calluses and shoot cultures over time. Experience from other perennial crops	Dr. Sundar Kalaipandian, Senior Researcher	University of Queensland, Australia
	15	Epigenetic and genetic studies on the control of somatic embryogenesis.	Dr. Clelia de la Peña, Senior Researcher	Centro de Investigación Científica de Yucatán, Mexico
	15	Microbiome studies & interactions in coconut in-vitro cultures	Dr. Luis Sáenz, Senior Researcher	Centro de Investigación Científica de Yucatán, Mexico
	10	*Question and Answer*		

Date	Min	Theme	Presenter	Affiliation
	15	**PANEL DISCUSSION**	Ms. Erlene Manohar & Mr. Vincent Johnson, COGENT Coordinators	International Coconut Community-International Coconut Genetic Resources Network, Indonesia
		End of Day 2		
Friday 06-May	30	Presentation of 10 Best Posters Awarding of the Top 3 Best Posters	Dr. Quang Nguyen, Chair of Poster Review Committee Dr. Jelfina Alouw, Executive Director	International Coconut Community, Indonesia
	5	**SESSION 6: SOCIOECONOMIC BENEFITS OF TISSUE CULTURE TECHNOLOGY TO COCONUT PRODUCERS & PROCESSORS AND ESTABLISHMENT/ STRENGTHENING OF INTERNATIONAL NETWORKS/ LINKAGES** **Session Chairperson: Mr. Benjamin Madrigal, Jr., ICC TWG Chairman**		
	15	Presentation of the output of roundtable discussions on TC for socioeconomic benefits to coconut producers & processors	Dr. Jelfina Alouw, Executive Director	International Coconut Community, Indonesia
	15	Participatory sharing of views on the synthesis/outcomes and to institutionalize and upscale the TC programme in support of the coconut industry	Coconut industry-linked Policymakers and Private Sectors), plus ICC-TWG members and ITAG 4 members	
	20	Presentation of International TC research programme	Dr. Carlos Oropeza, Senior Researcher	ITAG 4 - COGENT
	20	Panel discussion on TC research programme on establishment/strengthening of international networks and linkages	FAO-ITGRFA, ACIAR, Crop Trust, IFAD, Policy Makers, Private Sector; ICG representatives and ITAG4 members	Multisectoral Representatives
	30	Symposium highlights, synthesis closing remarks and way forwards (discussing whole 3-day symposium)	Ms. Erlene Manohar & Mr. Vincent Johnson, COGENT Coordinators	International Coconut Community-International Coconut Genetic Resources Network, Indonesia
		End of Day 3		

OBJECTIVES

To establish the status of the tissue culture technology and challenges with reference to coconut conservation through knowledge sharing, synergies, and provision of support toward achieving more sustainable coconut industry development. Specifically, the symposium aims to present advances, promote the merits, unify experts in bridging gaps and provide strategic platform for technology transfer and develop mechanism of protecting intellectual property rights.

There are six symposium sessions with high calibre experts from various parts of the globe. The 2nd International Coconut Tissue Culture was organized to lay down what were achieved in coconut tissue culture, the breakthroughs, prospects, and its application, as well as what needs to be achieved to address industry challenges.

In summary there are three major segments in the Symposium that have been tackled comprehensively by our elite and high calibre speakers in their respective areas of expertise. These are Technology Development, Perceived Application and Prospects.

SYMPOSIUM SESSIONS AND TOPICS

Session 1: The state of the art and challenges of coconut tissue culture globally

Topic 1.1: Coconut tissue culture: State of the art & global challenges

Topic 1.2: Embryo culture and transfer

Topic 1.3: Coconut somatic embryogenesis and micropropagation technology development

Topic 1.4: Coconut somatic embryogenesis- Unfertilized ovary

Topic 1.5: Micropropagation using axillary shoots

Topic 1.6: Acclimatization for ex vitro survival and development

Session 2: Coconut germplasm cryopreservation

Topic 2.1: Cryopreservation protocols for shoot-tip cultures

Topic 2.2: Cryopreservation protocols for coconut zygotic embryos

Topic 2.3: Cryopreservation protocols using coconut embryogenic callus

Topic 2.4: Cryopreservation protocol for coconut pollen

Session 3: Selection of coconut germplasm for in vitro culture

Topic 3.1: Genotype selection for cloning, yield & other characteristics for different countries.

Topic 3.2: Field screening for LY/ other phytoplasma resistance / susceptibility

Topic 3.3: Molecular Screening for resistance/susceptibility to major coconut insect pests and pathogens

Session 4: Tissue culture and Coconut Germplasm Exchange

Topic 4.1: Germplasm exchange through alternative cultures (EC callus, vitro-shoots/plants)
Topic 4.2: Risks of transferring pathogens through germplasm exchange

Session 5: Basic studies on embryogenesis towards its optimization

Topic 5.1: Gene expression analysis during coconut TC i.e., somatic embryogenesis

Topic 5.2: Develop screening methods to detect somaclonal variation

Topic 5.3: Genetic stability of embryogenic calluses and shoot cultures over time. Experience from other perennial crops

Topic 5.4: Epigenetic and genetic studies on the control of somatic embryogenesis

Topic 5.5: Microbiome studies & interactions in coconut in-vitro cultures

Session 6: TC for socioeconomic benefits to coconut producers & processors and Establishing / Strengthening (Inter)national networks/linkages for TC

ABSTRACTS OF THE TECHNICAL PRESENTATIONS

Title: Viability of heat-treated Microspores of Cocos nucifera L. for Induction of Microspore Embryogenesis

Authors:

S.P.N.C. Jayarathna[1], H.G.M.R. Suraweera[2], N.K.L.S. Piyatissa[2], P.I.P. perera[2*], V.R.M. Vidhanaarachchi[1]

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Tall coconut (Cocos nucifera L.) palm is an allogamous and highly heterozygous crop which is a major obstacle for conventional breeding. Microspore embryogenesis is a promising method which enables the development of homozygous lines. This study was conducted to evaluate the coconut microspore viability after heat treatment (at 38 °C) of different incubation periods and the effect of heat treatment on induction of microspore embryogenesis. Anthers were collected from the inflorescences of two coconut palms at three weeks before splitting stage and subjected to heat treatment for 1 to 10 days to test the microspore viability. Iodine potassium iodide, acetocarmine and 2, 3, 5-triphenyltetrazolium chloride were the stains used to test viability. Microspores were heat treated for 1, 3, 6 and 9 days, either prior or post inoculation in modified Eeuwens Y3 medium to examine the effect of heat treatment for microspore embryogenesis. Nuclear status and the callus formation were determined after 7 and 14 days of culture initiation. A significant difference in viability was observed among the two palms after applying the heat treatment. Iodine potassium iodide solution displayed a better distinguishability over the other stains. The highest frequency of binuclear (58.5%) and tetra nuclear (7.2%) microspores were recorded in the samples heat treated after culturing the microspores. The multinuclear stages of microspores indicated the induction of embryogenesis. The most effective heat treatment was 38 °C for 3 days after inoculation in Y3 medium. The results of the study are important for further improvement of microspore embryogenesis protocol.
Keywords: Coconut, heat treatment, viability, microspore embryogenesis

Title: Coconut Embryo Culture and Transfer

Authors: Cristeta A Cueto and Steve Adkins[2]

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Coconut (Cocos nucifera L.) is regarded to be the most important tropical palm; however, due to several factors including existence of senile palms, natural disasters, droughts and conversion of coconut farms for urban expansion and other agricultural needs, the valuable coconut germplasm is being rapidly lost. Thus, need for replanting with the new, higher yielding and disease-resistant types from the wide range of coconut germplasm. The collecting and movement of whole coconut fruit is clearly impractical due to its size and the risk of transferring pests with the fruit. The coconut embryo culture paved the way to modernize the collecting, exchange, conservation and mass production of the coconut germplasm. The collecting of coconut germplasm, either as individual embryo or as embryo within the endosperm plug, and then moving them as in vitro embryo cultures, has become a much more practical way of moving them. For countries without tissue culture laboratories, movement and exchange of embryo cultured seedlings was found beneficial. The in vitro culturing and germination of coconut zygotic embryos have been achieved on past numerous occasions, and until recently a standard, an internationally recognised coconut embryo culture technique known as the 'hybrid embryo culture technique, has been used. The physiological traits of the seedlings that are most likely affected by the technique are the development of root systems, their capacity to undertake photosynthesis and their susceptibility to contamination. Thus, a new in vitro hardening and ex vitro establishment protocol have been developed through a collaborative work undertaken in Australia, Indonesia, PNG, Philippines, and Vietnam. The paper will describe the newly developed protocol and examples of its use with a wide range of coconut varieties.

Title: The Development of screening methods to detect somaclonal variation; Genetic stability of embryogenic calluses and shoot cultures over time.

Author Names: Sundaravelpandian Kalaipandian, Eveline Kong, Sisunandar Sudarma, Robyn Cave, Julianne Biddle, and Steve Adkins

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Coconut (Cocos nucifera L.) is predominantly grown in tropical and subtropical regions of the world. Due to the recent awareness of its health benefits, the demand for coconut products is increasing dramatically every year. However, the production is decreasing due to senile palms, pests, and diseases. Among these issues, palm senility is one of the major problems contributing to reduced yields. According to the International Coconut Community, more than 50% of the world palms are over their productive life, and to be removed and the land replanted immediately. Replanting programs are impeded in many countries due to the lack of good quality planting materials. Production of high-quality seedlings via conventional methods are expensive, time consuming and laborious to produce, and cannot meet the current demand. Hence, recent studies are considering alternative approaches to meet these replanting needs, such as the large-scale production of high-quality plantlets by micropropagation. At present, this technology can be taken to the commercial scale, however, it is important to develop quality control steps to confirm the true-type nature of those micro propagated plantlets. Because certain tissue culture procedures involving a callus phase are known to induce

somaclonal variation in the plantlets. The genetic fidelity of the tissue culture-derived plantlets can be tested in various ways, using morphological, cytological, and molecular analysis. Recent developments in the sequencing of the coconut genome have identified several molecular markers that can be used to check for the genetic purity of the plantlets at an early stage of development. In this presentation, the currently available methods and techniques will be discussed for coconut researchers to test genetic fidelity of tissue culture-derived coconut plantlets.

Title: Ex vitro acclimatization of coconut (Cocos nucifera L.) seedlings: review and prospects

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Ex vitro acclimatization is the final and most critical step in most plant tissue culture pathways. Indeed, success of any tissue culture protocol is heavily dependent on this essential stage. In coconut (Cocos nucifera L.), several acclimatization systems have been developed including the plastic tent, the wooden box humidity chamber, the CO_2-enrichment chamber, and a mini growth chamber. However, these studies also indicated that each system has its own pros and cons. Often, the selection of a system relies on the availability of resources and the skills of the tissue culturists in any given space or time. Also, it is essential to consider three critical features of the acclimatization system viz. physiological attributes of the cultures, the media substrates to be used, and the environmental conditions during the acclimatization stage. Firstly, the physiological characteristics of in vitro cultures; this includes the growth and developmental state of the shoots and roots as this plays a significant role in deciding on the steps to use in the acclimatization procedure. Secondly, the selection of suitable potting substrate; this is important to stimulate root and overall plantlet growth during the ex-vitro acclimatization phase. Thirdly, the environmental conditions of culture; this includes relative humidity, illumination, and gaseous exchange within chamber, all are important to ensure the survival of the fragile seedlings in the in vitro environment in the final stage of tissue culture. In this review, we highlight the advantages and disadvantages of the various acclimatization systems that are currently available for coconut. From the review and analysis of the three critical factors, we make several recommendations to help coconut tissue culturists to select an appropriate acclimatization system that may best suit their resources and skills.

Title: Cryopreservation protocols for zygotic embryos

Authors: Steve Adkins, Amirhossein Bazrafshan, Sisunandar, Sundar Kalaipandian, and Julianne Biddle

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Grown on 12 million hectares across 90 countries, coconut (Cocos nucifera L.) is one of the world's most valued palm crops. This species contributes directly to the income for 20 million small-holder farmers and dependents, providing food, health benefits, structural products as well as aesthetic beauty to the landscape. However, despite its immense economic importance and multitude of uses, genetic erosion of its populations continues due to pest and disease attack, natural disasters and changes in land use pattern. Therefore, there is a need for an applicable and successful conservation protocol to create long-term germplasm collections of this species. Conventional conservation strategies applied to coconut are confronted by many problems since the coconut seed is recalcitrant and short-lived, and seed gardens are financially demanding and subject to environmental threats. Thus, cryopreservation is a promising solution for the long-term conservation of coconut germplasm. An efficient, and simple to apply protocol for the cryopreservation of coconut zygotic embryos using rapid physical dehydration has been developed. After isolation, mature zygotic embryos are surface sterilised and precultured in a Y3 medium supplemented with sucrose (0.4 M) for 5 days. The embryos are then physically dehydrated for 4 hours to a moisture content of 20% using a flash drying apparatus and placed individually into 2 mL cryovials and plunged directly into liquid nitrogen. To recover the cryopreserved embryos, the frozen vials are removed, warmed in a water bath at 40 ± 1°C for 3 minutes and then placed onto a recovery medium. A high seedling recovery rate of 60% has been achieved using the most recently optimized approach. So far, this is the best rate of recovery demonstrated to date for coconut and given the relatively simple nature of the method it could be applied in coconut genebanks that have laboratory facilities.

Title: Identification of a genomic region associated with the survival to Lethal yellowing, in West African Tall coconut palms from Ghana.

Author Names:
Andrea Garavito-Guyot
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Genetic markers have been fundamental for characterizing the existent genetic diversity of many important crops, and Coconut has not been the exception. With the advent of the new sequencing techniques, a detailed screening of the genome became realizable, opening the possibility for the identification of the genetic determinants of the resistance to major biotic and abiotic constraints. Lethal yellowing (LY), a disease associated with the presence of phytoplasmas, is currently the most important threat to coconut cultivation in many production sites worldwide. It causes considerable losses, due to the death of the majority of infected palms.

In order to identify the genomic region linked to the survival of LY infected plants, a case-control genome wide association approach was used. After identifying survivors in LY affected fields in Ghana, a sample of sawdust was collected for DNA extraction. As controls, plants from uninfected nearby fields were also collected. After DNA extraction and SNP calling, a region on the long arm of chromosome 8 was identified by five different statistical models as significantly associated to the survival phenotype. An haplotype analysis allowed the identification of the alleles of four highly linked markers associated with the survival, and 24 individuals bearing this allelic combination. The application of this approach to other populations opens the possibility to identify other genomic regions associated not only to the response to LY, but to other important diseases and pest.

Title: Field screening of coconut varieties for lethal yellowing disease resistance/susceptibility in Ghana

Egya Ndede Yankey (PhD)
Council for Scientific and Industrial Research-Oil Palm Research Institute, Sekondi, Ghana

The use of resistant or tolerant coconut varieties or hybrids is considered as the best approach for managing lethal yellowing-type diseases (LYD). In Ghana, LYD resistance screening trials have been ongoing since the 1950s. As of 1995, 38 varieties and hybrids had been screened for LYD resistance in Ghana. The results of these trials culminated in the development of a hybrid, MYD x VTT, which was used to rehabilitate devastated farms in a Coconut Sector Development Project. The hybrid, however, suffered some losses and is no longer recommended for planting by farmers. Another hybrid, SGD x VTT, is currently being planted by farmers and has not yet succumbed to LYD. In 2006, in a French Government funded project (FSP), eight dwarf varieties were imported from the Genebank in Cote D'Ivoire for LYD resistance screening at three locations in the Western and Central regions of Ghana. The results of these trials have shown four of the varieties to be promising in their resistance/tolerance to LYD. The agronomic assessment of these varieties is currently ongoing in an EU funded 'Tropicsafe Project'. Preliminary results have revealed either superior or comparable performance of the four varieties to the SGD x VTT hybrid. In 2016, in an International Development Research Centre funded project, two screening trials using six varieties were established in the Western and Central Regions of Ghana. The trials are yet to be affected by LYD. To facilitate detection of LYD in the field, DNA-based diagnostics using the loop-mediated isothermal amplification method have been developed for quick and cost-effective diagnosis of the disease. Molecular markers have also been developed for validating the breeding materials and to detect genetic contaminations.

Title: Standardization of cryopreservation method for coconut plumule based on vitrification technique using V-cryomesh

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Coconut (Cocos nucifera L.) is an economically important monotypic tropical plantation having enormous variability for its plant and nut characteristics. Cryopreservation is comparatively easy and best method for conserving the existing variability in coconut over maintenance of field gene banks. In the present study, a procedure was tried for cryopreservation of plumular regions based on vitrification technique using aluminium V-cryomesh as an anchoring material. Accommodation of smaller sized explants in large number and easy handling are the major advantages of cryomesh. Coconut plumular regions, excised from mature zygotic embryos, were pre-cultured in a solid Y3 medium supplemented with 0.2 M to 0.6 M sucrose. After pregrowth, explants were treated with loading solution (Y3 medium with 0.4 M sucrose + 2 M glycerol) and transferred to V-cryomesh and embedded using calcium alginate. Explants adhered to V-cryomesh were subjected to dehydration using PVS3 (40 min) and transferred to cryovials for storing in liquid nitrogen. After 48h of liquid nitrogen treatment, material was thawed at 40^{o}C for 2 minutes and later treated with unloading solution for 30 min and explants were inoculated to retrieval media. The optimal protocol involved preculture of plumules for 72 h on medium with 0.4 M sucrose followed by PVS3 treatment for 40 minutes, rapid cooling and rewarming and treating with unloading solution for 30 min. Under these conditions, 33% post thaw recovery and 7% plantlet recovery was observed. The method can be useful for conservation of valuable coconut germplasm in the form of plumules.

Title: Coconut Embryo Culture and Transfer

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[1] Philippine Coconut Authority (PCA) Albay Research Center

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Coconut (Cocos nucifera L.) is regarded to be the most important tropical palm; however, several factors including palm senility, pests and diseases, natural disasters and the loss of traditional coconut land to urban expansion and other agricultural needs, have all reduced coconut production worldwide. Thus, there is a need to replant traditional and new lands with new, higher yielding and disease-resistant varieties. The traditional method for mass production and conservation of the large-seeded, recalcitrant coconut is through germination in nurseries or seedbeds. However, coconut tissue culture has now modernized the collecting, exchange, conservation, and mass production of new coconut germplasm. The collecting of coconut germplasm, either as an individual embryo or as an embryo embedded within an endosperm plug, and its movement as in vitro embryo cultures, has become widely practiced. The coconut embryo culture process for coconut utilizes at least 10-month-old fruit as the embryo source. The nut is de-husked and split to extract the embryo or endosperm plug. The extracted embryo or plug is then disinfected, and in the case of the plug, the embryo needs to be excised. The embryo is then further disinfected under aseptic conditions and inoculated individually onto Eeuwens (1976; Y3) basal

medium supplemented with refined sucrose and activated charcoal. The embryo is allowed to germinate and develop into a fully developed seedling in vitro until ready for ex vitro soil establishment. Rapid in vitro acclimatization can be achieved through the culture of the seedlings in an atmosphere enriched with carbon dioxide which also promotes their physiological development. Acclimatization of this kind is being adopted in several laboratories around the world. After the in vitro acclimatization, the seedling are ready to be moved to soil and acclimatized further, under individual polybag for a period of 1 month or in a misting chamber for a period of 1 to 2 months prior to being transferred to a screenhouse, then to the field. The safe transfer of coconut germplasm using the coconut embryo culture technology allows for the movement of germplasm from laboratory to laboratory, or to other countries. Moreover, the approach of embryo rescue can be used to establish palms from the impossible to germinate coconut mutants, such as Makapuno or Kopyor. Research is underway to further improve the in vitro and ex vitro success rates, specifically for the ex-vitro field establishment of embryo cultured seedlings.

Title: Cryopreservation protocols for shoot-tip cultures of coconut

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Coconut genetic resources are endangered due to emerging pests and diseases, climate change as well as economic constraints. Conservation of the widest possible diversity is thus urgently needed. Up to now, ex situ conservation strategies are largely based on the development and maintenance of field collections. However, these field collections require a lot of maintenance, could lead to unwanted crosses between the varieties and are often competing for land use. Coconut palms produce highly recalcitrant seeds that are big, sensitive to desiccation and show no dormancy, which makes them difficult to be stored for a long-term using conventional techniques. Alternatives such as in vitro conservation, cryopreservation of plumules, pollen, zygotic and somatic embryos are currently being investigated and some of them are already applied on a limited scale. Cryopreservation, or conservation of biological materials at ultralow temperatures, will ensure that coconut genetic resources will be available for the next generations.

With the development the novel micropropagation technique for coconuts using axillary shoot multiplication, new opportunities for safe conservation of coconut genetic resources appear. In vitro shoot cultures can be stored under reduced growth conditions but also proliferating meristems clumps as well as apical meristems can be cryopreserved. Application of the droplet vitrification protocol to proliferating meristems resulted in a survival rate of up to 43 % for the cultivar Malayan Yellow Dwarf. When this cryopreservation technique was applied to individual meristems excised from regenerating shoots survival rates between 29 and 60 % depending on the cultivar were obtained.

Further optimization and application to more cultivars are needed with a focus on regenerating healthy in vitro plants that can be grown in the field.

Title: Genotype Selection for Cloning, Yield and Other Characteristics for Different Countries
Ramon L. Rivera, Philippine Coconut Authority

Coconut genotype selection is continually geared towards specifically chosen 'ideotypes' with outstanding heritable traits linked to maximum yield potentials based on desired target primary products, e. g. mature and/or young tender coconuts, meat/kernel, quality water, coco sap, stem for lumber, etc., resistance to known major and emerging diseases and pests, high tolerance to abiotic factors like drought and strong winds, as well as specific and outstanding traits of high economic and commercial importance. Different coconut growing countries face various crop related challenges to include environmental and socio-economic consequences of climate change and extremes justifying the decisive selection of the elite coconut genotypes. Another critical challenge is the mass production of these elite coconut planting materials. Decision makers are confronted with the issue of cost effectiveness and responsiveness of the chosen coconut tissue culture protocols against the current classical and commercially utilized breeding methods.

Title: In vitro regeneration from plumular explants in coconut: protocol refinement using the novel aromatic cytokinin meta-topolin

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The present study describes a regeneration protocol for coconut from plumular explants using meta-topolin, an aromatic natural cytokinin. Plumular explants, obtained from West Coast Tall cultivar of coconut, were initially cultured in agar-gelled M72 media supplemented with the synthetic plant growth regulators, 5 μM meta-topolin [6-(3-hydroxybenzylamino) purine] and 100 μM picloram (4-amino-3,5,6-trichloropyridine-2-carboxylic acid) . Twenty days after culture initiation callus formation was observed in 90% of the plumules. In the subsequent subcultures, picloram and metatopolin were serially reduced i.e., 100→50→25→5→1→0.5 μM (picloram) and 5→2.5→1 μM (meta-topolin), which resulted in the induction of meristemoids. Individual shoots from the meristemoid clumps were carefully separated and cultured in Y3 media supplemented with 4.4 μM 6-Benzylaminopurine and 2.69 μM 1-Naphthaleneacetic acid. About 30 shoots were obtained from a single plumule. Rooting was induced in 40% of the developed shoots in liquid Y3 media supplemented with IAA and IBA 2.85 μM and 2.46 μM each. For hardening, rooted plantlets were transferred to pots with potting mixture cocoa peat, perlite and humic acid and 66% survival was observed. This paper highlights the beneficial role of meta-topolin in shoot induction and plantlet regeneration in coconut for the first time.

Title: Micropropagation of coconuts using axillary shoots

Hannes Wilms[1] and Bart Panis[1,2]
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The demand for coconut products, such as coconut-oil, -water and -milk, is rising worldwide. However, coconut production is currently not able to keep up with the demand, due to ageing plantations, pests and diseases. To deal with this, we developed an innovative clonal micro propagation method, that enables mass production of desired varieties.

A novel micropropagation method is therefore presented, based on axillary shoot formation and multiplication. For this, apical meristems or halved shoot pieces, both derived from in vitro coconut seedlings, are cultured onto Y3 medium containing 1 µM TDZ, a phenylurea derivative that shows cytokinin-like activity. This induces the apical meristem to proliferate through axillary shoot formation. We tested our protocol on 6 cultivars representing the coconut diversity, belonging to both tall and dwarf types and observed that 20 to 30 percent of the initiated explants responded favourably. The axillary shoots are seen as white clumps of proliferating tissue that can be multiplied at a large scale or regenerated into rooted in vitro plantlets.

This technology presents many advantages and applications; (i) clonal propagation of coconut plants with identical characteristics to create the opportunity to propagate and plant solely elite trees, (ii) large-scale propagation of coconut palms to better respond to increased market demand in a more flexible way, (iii) compared to an already existing clonal propagation method for coconuts called somatic embryogenesis, the present protocol does not involve a callus phase; plants are thus believed to be genetically more stable, (iv) the propagation protocol is fast, user-friendly and can be applied in virtually all tissue culture laboratories and (v) the tissues and shoots obtained through this method can be used to establish coconut germplasm collections through in vitro culture and/or cryopreservation

Title: Risks of transferring pathogens through germplasm exchange

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The coconut palm is referred to as the ‘tree of heaven’ as every part of the palm is useful in one way or the other. The palm is grown in more than 90 countries in the world and a vast genetic diversity in the palm has been documented. Harnessing and conserving the diversity in coconut and their global distribution is very much essential for boosting coconut productivity and addressing the challenges posed due to climate change or pest and disease epidemics. Transboundary spread of pathogens along with germplasm transfer is a major concern across the world as the infected germplasm itself may act as the primary source of inoculum introducing the disease/pathogen to newer geographical locations. Even though more than 100 pathogens are known to infect coconut the world over, certain diseases like cadang-cadang caused by viroid, foliar decay caused by coconut foliar decay virus, and lethal wilt disease caused by aster yellows group phytoplasma are restricted to certain geographic locations. Seed nuts, embryo and pollen grains of coconut can harbour phytopathogens. Seed nuts can act as a carrier of fungal pathogens like Marasmiellus cocophillus (lethal bole rot pathogen), phytoplasma and viroids. Though germplasm movement through pollen and embryo culture is considered relatively safer compared to the exchange of seed nuts or seedlings, the reports on the presence of phytoplasma in the embryo of lethal yellowing (LY), Cape St. Paul wilt disease (CSPWD) and root (wilt) diseases (RWD) affected coconut palms raises our concern. The presence of coconut cadang cadang viroid in pollen and seed nuts from diseased palms has also been established. The report on the detection of LY phytoplasma in coconut plantlets obtained through in vitro culturing of the embryo from the seed nuts of diseased palms indicates the possibility of phytoplasma transmission through embryo cultures also. The presence of phytoplasma/viroids in embryo/pollen grains poses a great threat to international germplasm exchange and indicates the need for the development of disease-specific protocols and standard operating procedures for safe germplasm exchange. In recent years tremendous progress has been made in the molecular detection of plant pathogens and this can be utilized in the safe germplasm transfer. Development of standard protocols for in vitro generation of disease-free plantlets by embryo culture, development of simple disease detection protocols and following the basic principle of avoiding the collection of seed nuts/ embryo/pollen grain from diseased palms/disease-endemic areas will help in reducing the risk of pathogen transfer. Testing the health of germplasm before export and import in accordance with the International Standards for Phytosanitary Measures of the International Plant Protection Convention (IPPC) and the FAO-International Board for Plant Genetic Resources (IBPGR) technical guidelines help in ensuring the safe movement of coconut germplasm. The global status of coconut diseases, diagnostic procedures, the importance of tissue culture in disease/pathogen-free germplasm exchange, limitations and the way forward are discussed in the paper.

Title: Molecular aspects of coconut somatic embryogenesis: Insights from OMICS approaches

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The application of somatic embryogenesis to mass propagation of elite coconut genotypes is fraught with many limitations. These limitations include the differential response of genotypes, the induction conditions, intense browning of explants, low rate of formation of embryogenic calli and somatic embryos, maturation and conversion of somatic embryos, among other factors that compromise the development of an efficient protocol for in vitro regeneration of coconut via somatic embryogenesis. It is essential to understand, identify, and characterise molecular events involved in the coconut somatic embryogenesis pathway to overcoming the bottlenecks in somatic embryogenesis in coconut. The use of OMIC technologies has contributed to identifying and characterising the gene expression patterns during the acquisition of embryogenesis competence. Transcriptome analysis (RNA-Seq) of coconut embryogenic calli, derived from plumular explants, has provided insights into the repertoire of genes involved in coconut somatic embryogenesis. These include protein kinases like receptor-like kinases [somatic embryogenesis receptor kinase (SERK) and CLAVATA 1 (CLV1)], mitogen-activated protein kinase (MAPK), transcription factors [WUSCHEL (WUS), APETALA2/Ethylene-responsive factor (AP2/ERF), PICKLE (PKL), AINTEGUMENTA (ANT), and WRKY], extracellular proteins [arabinogalactan protein (AGP), Germin-like protein (GLP), embryogenic cell protein (ECP), and late embryogenesis-abundant protein (LEA)] and glutathione S-transferase (GST). Comparative genome-wide profiling of small RNAs from embryogenic and non-embryogenic calli has revealed that a few conserved microRNAs (miRNAs) and species-specific miRNAs act to regulate coconut somatic embryogenesis. Also, a study of the relationship between long non-coding RNAs (lncRNAs), microRNAs (miRNAs) and mRNAs has divulged that some of the lncRNAs act as miRNA precursors, are potential miRNA targets and also function as endogenous target mimics (eTMs) for miRNAs. These studies provide an overview of the molecular regulation of somatic embryogenesis in coconut and offer promising strategies for fine-tuning or reprogramming to enhance somatic embryo turnover in coconut.

Title: Coconut somatic embryogenesis and micropropagation technology development and perspectives

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A micropropagation technology has been developed at CICY in Mexico using plumule or inflorescence explants. It is based on somatic embryogenesis and the formation of embryogenic calluses. High

efficiency has been achieved through embryogenic callus multiplication and secondary somatic embryogenesis; this way thousands of somatic embryos can be obtained from an explant. Somatic embryos germinate on the embryogenic calluses and grow into developing shoots. These shoots are separated from the embryogenic calluses, cultured individually and allow to convert into fully developed plantlets. These plantlets are acclimatized in greenhouse / nursery conditions to grow and be ready for establishment in the field. Testing these plants in the field comparatively with plants from seed, grew and behaved similarly, they produced female and male flowers that were able to produce viable progeny, which in turn grows into similar bearing plants. Production has been scaled-up and transferred to a biofactory established by CICY. Different genotypes, including tall, dwarf and hybrid coconuts, have been selected after been tested for lethal yellowing disease resistance and yields, and are been micropropagated. We are starting testing a stepwise technology transfer process into the CICY's biofactory and two laboratories in the Caribbean region.

Title: Cryopreservation protocols using coconut embryogenic callus.

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Coconut palm is a crop of great global importance, due to the high number of products obtained from its palm, which can be fully exploited. Like most important crops, there is great genetic diversity associated with the species and it is important to preserve it. The traditional conservation of the coconut palm consists of populations in the field, which is risky, since there may be loss of the palms due to the biotic and abiotic factors to which they are exposed. Additionally, by not controlling cross-pollination between genotypes, there is a risk of losing the genetic integrity of the preserved populations. Coconut nuts are its seeds, which are unorthodox and large, so their conservation in germplasm banks is not feasible. Because of that, there is a need for a safe long-term conservation method to protect the genotypes of this important species. An alternative is cryopreservation of in vitro clonal plant tissue, which allows pathogen-free plant tissue to be preserved for a long period under controlled conditions, without losing viability or genetic integrity in confined spaces. Currently there are different cryopreservation techniques applied to different coconut tissues. Despite this, there is still no efficient protocol for embryogenic callus cryopreservation, which has multiple advantages as tissue for conservation, since each embryogenic callus has the potential to produce multiple somatic embryos and therefore plants. To achieve this goal, using D and V cryoplates cryopreservation could be evaluated, which are technically unchallenging procedures and provide high recovery rates due to the ultra-rapid cooling of the tissue achieved by the use of aluminum cryoplates. Establishing protocols for embryogenic callus cryopreservation will potentially allow the establishment of global networks for the conservation of cryopreserved embryogenic lines.

Title: Epigenetic and genetic studies on the control of somatic embryogenesis

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In vitro plant cell and tissue culture techniques are the basis of many micropropagation and breeding programs for scientific research. Plant tissue culture (PTC) involves organogenesis and embryogenesis, and the outcome depends on the different conditions to which the tissue is exposed. PTC is a stressful environment – high relative humidity, low ventilation rate, high concentrations of plant growth regulators, and low light availability – for plants that need to rapidly change their molecular regulation in order to respond fast and efficiently during cell division and growth. New data has come out about a connection between plant morphogenesis and epigenetics. Epigenetics is a very sensitive regulatory mechanism, which in most of cases is affected by the environment. Although it is known that, under plant morphogenesis, the genome has little or no change, DNA methylation and histone modifications are very susceptible to those in vitro environmental conditions. Coffea spp. and Cocos nucifera L. are two successful cases of plants propagated in vitro that need to remodel their chromatin in order to generate new organs. In the present work, I will talk about how key genes related to embryogenesis are regulated by DNA methylation and histone modifications and how it will be important to identify factors that help to find climate-resistant plant and increase plant productivity.

SYNTHESIS

DAY 1. TECHNOLOGY DEVELOPMENT

Session 1. State of the Art of the Tissue Culture Technology and Challenges

The first session mainly provides the status, existing gaps and challenges of developing this technology. The decades of evolution of the technology were presented that started in the 1990s and its advancement through time. Various protocols were initiated by various laboratories with the aim of achieving a standard protocol using prospective coconut tissues that will be efficient and feasible for conservation and mass propagation of quality planting materials. But, in every pathway of development bottlenecks and limitations were encountered. Among these are:

1. Lack of fully developed and tested in vitro regeneration protocol
2. Insufficient exchange of information between active groups involved in coconut tissue culture
3. Insufficient funds especially for hiring manpower and acquiring infrastructure
4. Lack of problem-solving capabilities
5. Insufficient basic studies that decipher the physiological, biochemical, and molecular mechanism during in vitro regeneration.

Speakers discussed working protocols such as the embryo culture, transfer and acclimatization. This in vitro culturing and germination of coconut zygotic embryos have been achieved in the past on numerous occasions and standard new in vitro hardening and ex vitro establishment protocol have been developed through a collaborative work undertaken in Australia, Indonesia, PNG, Philippines, and Vietnam. The presentation on coconut somatic embryogenesis and micropropagation by Dr Oropesa which was developed in CICY, Mexico is the most advanced. In this technology, selected germplasm can be cloned to produce tens or hundreds of thousands of plantlets per year at a single facility using plumule or inflorescence tissue as starting material or explant. High efficiency has been achieved through embryogenic callus multiplication and secondary somatic embryogenesis; this way thousands of somatic embryos can be obtained from a single explant. Production has been scaled-up and transferred to a biofactory established by CICY.

Another novel micropropagation method is based on axillary shoot formation and multiplication. This technology presents many advantages and applications; (i) clonal propagation of coconut plants with identical characteristics to create the opportunity to propagate and plant solely elite trees, (ii) large-scale propagation of coconut palms to better respond to increased market demand in a more flexible manner, (iii) compared to an already existing clonal propagation method for coconuts called somatic embryogenesis, the present protocol does not involve a callus phase; plants are thus believed to be genetically more stable, (iv) the propagation protocol is fast, user-friendly and can be applied in virtually all tissue culture laboratories and (v) the tissues and shoots obtained through this method can be used to establish coconut germplasm collections through in vitro culture and/or cryopreservation.

Despite the success and advances of the various protocols undertaken in most laboratories, Dr Quang in his report emphasized the need for improving the survival rate of the plantlet during the acclimatization stage. He mentioned 3 major factors to consider the physiological characteristics of in vitro cultures; the selection of suitable potting substrate; to stimulate plantlet growth during the ex-vitro acclimatization phase and the environmental conditions of culture. The key to utilization of the technology is dependent on how many ex-vitro plantlets will survive under field conditions.

Session 2: Cryopreservation protocol

The major drawback in coconut genetic resources conservation is due to inevitable constraints and risks brought by emerging pests and diseases, climate change as well as economic constraints. Conventional conservation strategies applied to coconut are confronted by many problems since the coconut seed is recalcitrant and short-lived, and seed gardens are financially demanding and subject to environmental threats. Thus, cryopreservation is a promising solution for the long-term conservation of coconut germplasm. An efficient, and simple protocol for the cryopreservation is via the use of plumules, pollen, zygotic and somatic embryos that are currently being investigated and some of them are already applied on a limited scale. There is a need for an applicable and successful conservation protocol to create long-term coconut germplasm collections.

Another alternative protocol is the use of embryogenic callus cryopreservation which is technically unchallenging procedures and provide high recovery rates due to the ultra-rapid cooling of the tissue and this has potential to allow the establishment of global networks for the conservation of cryopreserved embryogenic lines which allows pathogen-free plant tissue to be preserved for a long period under controlled conditions without losing viability or genetic integrity. So far, still no efficient protocol for embryonic callus preservation exists. As such using cryopalted cryopreservation can be considered for evaluation. In addition, a procedure was tried for cryopreservation of plumular regions based on vitrification technique using aluminium V-cryomesh as an anchoring material which was tried in ICAR-CPCRI. Accommodation of smaller sized explants in large number and easy handling are the major advantages of cryomesh protocol. The method can be useful for conservation of valuable coconut germplasm in the form of plumules.

DAY 2. TECHNOLOGY APPLICATION AND IINNOVATIONS

Session 3: Selection of Coconut Germplasm for In Vitro Culture

As presented by Mr Ramon Rivera, in coconut genotype selection for cloning, more emphasis was given towards chosen 'ideotypes' with outstanding heritable traits linked to maximum yield potentials based on desired target primary products, e. g. mature and/or young tender coconuts, meat/kernel, quality water, coco sap, stem for lumber, etc., resistance to known major and emerging diseases and pests, high tolerance to abiotic factors like drought and strong winds, as well as specific and outstanding traits of high economic and commercial importance. However, the critical challenges are the issues of cost effectiveness and responsiveness of the chosen coconut tissue culture protocols against the current classical and commercially utilized breeding methods. As, such studies to lower the cost of production and increase production using the tissue culture protocols is the priority area of research that would address this drawback as far as application and adoption of the technology is concerned.

In the case of diseases, the use of resistant or tolerant coconut varieties or hybrids is considered as the best approach for managing lethal yellowing-type diseases (LYD). To facilitate detection of LYD in the field, DNA-based diagnostics using the loop-mediated isothermal amplification method have been developed for quick and cost-effective diagnosis of the disease. Molecular markers have also been developed for validating the breeding materials and to detect genetic contaminations. Genetic markers have been fundamental for characterizing the existent genetic diversity of many important crops. With the current advances of sequencing techniques, a detailed screening of the genome is possible for the identification of the genetic determinants of the resistance to major biotic and abiotic constraints.

Session 4. Tissue Culture and Coconut Germplasm Exchange

Transboundary spread of pathogens along with germplasm transfer is a major concern across the world as the infected germplasm itself may act as the primary source of inoculum introducing the disease/pathogen to newer geographical locations. Though germplasm movement through pollen and embryo culture is considered relatively safer compared to the exchange of seed nuts or seedlings, the reports on the presence of phytoplasma in the embryo of lethal yellowing (LY), Cape St. Paul wilt disease (CSPWD) and root (wilt) diseases (RWD) affected coconut palms raises our concern. The presence of coconut *cadang cadang* viroid in pollen and seed nuts from diseased palms has also been established.

Standard protocols for in vitro generation of disease-free plantlets by embryo culture, and development of simple disease detection protocols following the basic principle of avoiding the collection of seed nuts/ embryo/pollen grain from diseased palms/disease-endemic areas will help in reducing the risk of pathogen transfer. Formulation of technical guidelines for international germplasm exchange is the logical approach in ensuring the safe movement of coconut germplasm. It was suggested that with the global status of coconut diseases, the need to develop diagnostic procedures and tissue culture is the key to warrant disease-free planting materials for germplasm exchange,

Session 5. Basic Studies on Embryogenesis Towards It's Optimization

Production of high-quality seedlings via conventional methods are expensive, competing in the supply capacity to address the industry demand. It is also time consuming and laborious to produce and cannot meet the current demand for the planting and replanting of most coconut growing countries. Hence, alternative approaches to meet the replanting needs, such as the large-scale production of high-quality plantlets by micropropagation, needs to be prioritized to accelerate the industry development. Thus, these available tissue culture protocols require further optimization and basic studies to ensure the expected outcomes.

The application of somatic embryogenesis to mass propagation of elite coconut genotypes encountered many limitations. These include the differential response of genotypes, the induction conditions, intense browning of explants, low rate of formation of embryogenic calli and somatic embryos, slow maturation and conversion of somatic embryos, among other factors, compromise the development of an efficient protocol for in vitro regeneration of coconut via somatic embryogenesis. It is essential to identify, and characterise aftermaths involved in the somatic embryogenesis pathway to address the bottlenecks in somatic embryogenesis in coconut. The use of OMIC technologies has contributed to identifying and characterising the gene expression patterns during the acquisition of embryogenesis competence.

Based on the various reports on the use of embryonic calluses and shoot culture, these can be applied to commercial scale, however, genetic stability must be ascertained over time. It is essential to have confirmatory protocol or quality control steps to validate the true-type nature of those micropropagated plantlets. This is because in some cases of tissue culture procedures involving a callus phase are known to induce somaclonal variation in the plantlets. The genetic fidelity of the tissue culture-derived plantlets can be tested in various ways, using morphological, cytological, and molecular analysis. Recent developments in the sequencing of the coconut genome have identified several molecular markers that can be used to check for the genetic purity of the plantlets at an early stage of development.

In vitro plant cell and tissue culture techniques are the basis of many micropropagation and breeding programs for scientific research. Plant tissue culture (PTC) involves organogenesis and embryogenesis, and the outcome depends on the different conditions to which the tissue is exposed. PTC is a stressful environment – high relative humidity, low ventilation rate, high concentrations of plant growth regulators, and low light availability – for plants that need to rapidly change their molecular regulation to respond fast and efficiently during cell division and growth. Based on the epigenetic studies on the control of somatic embryogenesis, new data has come out about a connection between plant morphogenesis and epigenetics. Epigenetics is a very sensitive regulatory mechanism, which in most of cases is affected by the environment. Although it is known that, under plant morphogenesis, the genome has little or no change. In the present work by Dr Clelia dela Pena, she presented how key genes related to embryogenesis are regulated by DNA methylation and histone modifications and how it will be important to identify factors that help to find climate-resistant plant and increase plant productivity.

DAY 3. OUTCOMES & IMPACTS

Session 6. Socioeconomic benefits of Tissue Culture Technology to Coconut Producers and Processors and Establishment/Strengthening International Networks/Linkages

Limitations and Advantages of the Coconut Tissue Culture Protocols Developed

It was emphasised that economic feasibility studies of the efficiency of CTC protocol have to be established to formulate methodologies and optimize the potentials of the technology and reducing the cost of per unit of output. Further research in increasing the efficiency of protocol can reduced the price of the CTC plants and can be made affordable to the coconut farmers.

In adopting and accessing the CTC technologies developed or upscaled with the investment of the private sector, there must be a clear mechanism to jointly benefit from this research generated outputs. It is a rule of thumb in R & D that technologies are protected by patenting, but the optimization of these technologies could be done collaboratively and develop flexible patenting to protect the technology. There is a need to guarantee quality control and to ensure that benefits can be shared amongst the participants. There is need to view tissue culture initiatives and protocols in the context of its value in the whole scope of coconut programmes. Government collaboration can speed up development of tissue culture protocols and we can build on the existing infrastructure. However, in cases where there is political inability to construct government facilities the private sector could help to have a more stable, comprehensive and inclusive CTC R & D program

Socioeconomic Impacts of the Coconut Tissue Culture Technology on the Coconut Industry

The industry needs to produce genetically uniform material across the many different users and should be provided with facilities for technology transfer. David Lobo provided an example of how their foundation of NGO helps small farmers by providing discounted seedlings and affirmed that tissue culture is the best way to grow the numbers or scale up. The socioeconomic advantages of this technology are dramatic and will increase impacts. He also suggested that with the 12 million hectares, 67 billion nuts per year of production where 50% are planted with senile trees, the actual requirement of 900 million nuts. The need to ensure also strong rooted high performing varieties which can respond after typhoons. The huge numbers of senile trees, the demand for good planting material is highly critical. There is also a need to diversify in terms of varieties which can provide high value products such as biofuels, coco sugar and VCO. Hence, CTC protocols will be useful in selecting the best material for breeding, planting and replanting program. David Lobo also asserted that the demand figures for planting materials globally is vastly underestimated which could be 42% instead of 21%.

Priority R & D and Key Areas of Collaboration

1. Optimization of the various process to reduce costs of production
2. Cryopreservation of embryogenic callus (EC) to reduce labour and conserve Embryo Culture lines to reduce risk of soma clonal variation.
3. Germplasm exchange through the alternative in vitro cultures (i.e. embryogenic call, shoots)
4. Genetic improvement with reference to pest and disease resistance collaborating with countries with such problems (e.g. Jamaica and Brazil)
5. Research on the development of resistance markers
6. Basic studies on cell suspension culture/optimization
7. Use of “-OMICS” techniques to decipher in vitro recalcitrance

Way Forward and Future Plans

1. Priority plans to consider the application of CTC for coconut genotype selection with reference to the needed quality traits of high yield and production of high -value products.
2. Research on the application of CTC technology in support of the germplasm exchange as major concern of the coconut genetic resources conservation in relation to biosecurity protocol.
3. Optimization and upscaling of the available CTC protocols as a tool in varietal improvement for mass propagation and to consider in breeding for pest tolerance and disease resistance that will facilitate germplasm exchange.
4. Obtaining a repetitive, economically viable, non-destructive sampling, mass multiplication protocol for production of coconut plantlets within a short span of time.
5. Utilization/Evaluation of tissue culture protocols of CICY, Bioversity/CIAT/ICAR-CPCRI/CRI and PCA
6. Establish a network platform for Coconut Tissue Culture to scale up plantlet regeneration and germplasm cryopreservation through international collaboration.
7. Utilization of promising cryopreservation protocols to conserve the elite germplasm and conservation of elite high calibre experts and trained junior researchers as component of the succession plan in R and D program.

Appendix 4: Coconut Tissue Culture and Cryopreservation Unified Research and Development Program

Introduction

The state of the art of the Coconut Tissue Culture (CTC) protocols as presented in the recent International Coconut Tissue Culture Symposium in May 2022 triggered the cohesive efforts of researchers, scientists, and renowned experts to develop a CTC R & D program. This is considered as a major COGENT initiative that will support strengthening its technical foundation for better genebank management and safe germplasm exchange. Likewise, efficient CTC protocols are critical for addressing the urgent need for quality planting materials globally. So far, CTC protocols based on somatic embryogenesis and the newly-developed axillary shoot multiplication protocol are available and were shared during the ICC-COGENT workshop held in May 2022 in CPCRI, Kerala, India. In this workshop experiences and challenges were shared and junior researchers from COGENT member countries were trained in CTC and cryopreservation protocols. The commitment of these researchers and experts have made current CTC innovations more promising and accessible. Hence, CTC technology can create significant opportunities in mass propagation and conservation initiatives critical to accelerating the coconut industry's modernization.

Coconut TC is an indispensable tool for mass clonal propagation of coconuts for producing the needed quality planting materials for planting and replanting programs to boost productivity and production of material to supply the coconut industry. This CTC technology is also important to help ensure safe germplasm exchange as a key component of a coconut germplasm biosecurity protocol. Moreover, CTC is critical to the successful conservation of coconut's genetic diversity . Using CTC technology will also boost ongoing varietal improvement through modern breeding initiatives and screening for pest and disease resistance, or other traits of interest.

This first CTC and Cryopreservation Workshop was organized by COGENT with the support of ICC as a major activity of the ACIAR-DFAT funded project held in India. It aimed at sharing practical experiences and knowledge among CTC experts and trainees. This ICAR-CPCRI-hosted workshop provided the venue for transferring technologies and enhanced knowledge for junior scientists. The training/workshop on CTC and Cryopreservation protocols will thus provide the means to effectively implement safe germplasm exchange and mass propagation. This activity also paved the way forward by developing a comprehensive and inclusive CTC and Cryopreservation Research and Development Program focusing on the utilization of the technologies for more effective germplasm conservation, exchange and use in the short, medium and long term.

The training/workshop provided scientific techniques conducted in various laboratories under the guidance of the experts who developed their respective protocols. The learnings and the insights provided by the experts and contributions of the trainees were utilized as inputs in the development of the R & D program with the involvement of the representatives from the genebanks (ICGs/NCGs) host countries. Country reports were presented from, India, Indonesia, Malaysia, Papua New Guinea, the Philippines, Sri Lanka and Vietnam. Other countries could not be represented due to travel restrictions still being implemented. During the workshop major CTC challenges were raised such as problems with acclimatization of CTC plantlets, tissue browning, varying and often low morphogenic responses depending on the cultivar, contamination, unequal levels of knowledge, limited availability of trained staff, limited access to high quality material, low plant regeneration rates following somatic embryogenesis and the long-time span needed to execute the CTC protocols.

Recommendations were formulated to address these issues including: building-up an efficiently communicating network, providing regular trainings/workshops with appropriate scientific guidance, and monitoring. There is also the need to have better access to old and recent CTC literature, continuous skill development of junior researchers, resource mobilization, sharing collaborative efforts and formulation of protocols for the safe movement of zygotic embryos and other CTC explants. The CTC and Cryopreservation R & D program developed during the workshop/training identified the key priority areas such assessment of the state of the art of CTC, the opportunities, intellectual property rights (IPR)/Patenting the protocols, effective communication/promotion, establishment of networks/linkages, resource mobilization and capacity building. For the R & D targets of the CTC Program based on the status of the CTC and Cryopreservation R & D and country reports, the following plans are presented in the table below.

SHORT-TERM (1-3 years)	MEDIUM TERM (3-5 years)	LONG-TERM (>5 years)
3. Development of standardized acclimatization techniques for in vitro plantlets derived from somatic embryogenesis as well as axillary shoot multiplication including regular capacity building for researchers	1.Optimization of Coconut plumule Somatic Embryogenesis protocols (CSE, axillary shoot) and use of inflorescence for mass propagation	Proofs-of-concept (field-evaluation of the performance of CTC plantlets under various climatological conditions)
Comparative assessment of the major CTC protocols with focus on somatic embryogenesis and axillary shoot formation	2.Establishment of zygotic embryo cryobanks	Comparative evaluation of the multiplication capacity of the protocols
5. Economic assessment of CTC plantlets' production and demand projections through the development of business for technology commercialization	3. Field validation of the axillary shoot protocol	Somaclonal variation screening in TC plantlets (tall types/ crosses) derived from the different protocols
6. Establishment of the global CTC R & D network including academic institutions and private sector	Development of new approaches to accelerate EC for utilization	Feasibility Study and Formulation of Long-Term Sustainability Plan for Industry Use.
7. Establishment of one or more pollen cryobanks		
8. Comparative evaluation of available cryopreservation protocols for zygotic embryos		

These plans are outputs of the CTC/Cryopreservation workshop and in summary viable outcomes generated are experiential learning through sharing, knowledge acquisition, information exchange, collaborative strategies, and the development of ITAG 4's R & D Program and Action Plan.

Appendix 5: 20th Steering Committee Report

20th Steering Committee Meeting of the International Coconut Genetic Resources Network (COGENT), 22nd to 25th July 2020 (Virtual).

International Coconut Genebank for Africa and the Indian Ocean, Port Bouet, Côte d'Ivoire

ICC-COGENT October 2021

1 BACKGROUND

Across the tropics, millions of growers are doing a great job in producing coconuts as an important local cash and food crop, which is still globally under-supported. More than 1000 accessions, accounting for more than 420 distinct genotypes, held in five international coconut genebanks[8] (ICGs) and many of the 19 national coconut collections are poorly conserved and underused. The International Coconut Genetic Resources Network (COGENT), with 39 coconut-growing countries as members was established in 1992[9]. COGENT has the mandate for coordinating efforts to conserve and promote greater use of coconut genetic resources. However, international support for COGENT has been dwindling, until ACIAR and DFAT provided support for revitalizing the network, which has been hosted by the Jakarta-based International Coconut Community (ICC) since 2018. The recent arrangement aims to ensure technical support for the implementation of COGENT's recently formulated Global Strategy for Conservation and Use of Coconut Genetic Resources (the Strategy) and to deliver:

5. A functioning and sustainable **COGENT Program**, coordinated by a financially accountable ICC, with a full-time coordinator based at ICC, Indonesia, supported by the Secretariat of the Pacific Community (SPC), with an assisting coordinator based at SPC in Fiji, and support staff in Indonesia, with links to Asia, Africa and Latin America.
6. An **implementation workplan and budget** for the Global Strategy, highlighting links to the Pacific region. Part of this deliverable will flow from 4 **fully established International Thematic Action Groups (ITAGs).** The COGENT Coordinator is ultimately responsible for strategy implementation in direct cooperation with ITAG leaders.
7. A **status report on coconut genetic resources** held in trust in the five multi-site international genebanks and in the national collections in 19 coconut growing countries, along with **recommendations for restoring a functioning international multilateral system** and initial support for effectively sharing coconut germplasm for the benefit of breeding programs, as a strategy to improve coconut productivity and linked livelihoods, across the Asia-Pacific and beyond.
8. **Income-generating components** and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

Having a fully functional COGENT will play a pivotal role in ensuring the more effective conservation and use of coconut genetic resources, and will contribute to building coconut stakeholders' capacity and resilience across the value-chain. Current work will ensure that the capacity to conserve the genetic diversity of coconut is preserved and contributes to ACIAR's long-term program of work to rejuvenate the coconut industry in the Pacific.

COGENT has a Steering Committee (SC) composed of Chair and Vice-chair (the previous chair) plus voting regional representatives each from the five regions and an ICC representative, and observers from international organisations. The SC provides policy and technical oversight. The SC traditionally meets biennially, back-to-back with the ICC

[8] in Brazil, Côte d'Ivoire, India, Indonesia and Papua New Guinea.

[9] by the International Plant Genetic Resources Institute IPGRI- which became Bioversity International, and then part of the CGIAR Alliance of Bioversity & CIAT

COCOTECH meeting, but the Covid 19 Pandemic has meant this 20th SC meeting is being held virtually.

2 MEETING OUTLINE

ICC's COGENT programme held its first virtual online SC meeting (20th SC meeting altogether) between 22 and 25 June. Over four 2-hour daily sessions, a total of more than 50 coconut expert delegates (40% female) attended from 29 institutions spread across 26 countries spanning 12 time-zones from Mexico/ Brazil to Fiji/Australia (see annex 1). This meant westernmost delegates had to attend at 5-7am and easternmost delegates at 22-24h, so COGENT acknowledges their sacrifices. Almost 40 delegates attended each day, indicating high levels of engagement.

The meeting had originally been scheduled as a face-to-face meeting in March 2020, to be hosted by the Indonesian Palm Research Institute, Balit Palma, Manado, back-to-back with a planned appraisal of the International Coconut Genebank for South East Asia (ICG-SEA) housed at Balit Palma. The COVID-19 pandemic prevented the physical visit, so a virtual meeting was organised.

The main meeting objectives were to:

1. 'Reboot' COGENT as a viable network, and provide a forum for the global coconut community to understand the scope of work scheduled within the new ACIAR/DFAT grant GP/2018/193: Supporting an international initiative to maintain the international coconut genetic resources network (COGENT)
2. Begin developing a strong, collaborative and sustainable network from within the International Coconut Community (ICC),
3. Formally agree on the Steering Committee (SC) membership,
4. Address COGENT's global strategy implementation,
5. Discuss next steps and articulate action points/ recommendations.

The face-to-face meeting agenda was participatorily articulated during the January planning meeting, and for 7-hour daily sessions over four days (see annex 2). When it was evident that we needed to hold a virtual meeting, the agenda was adjusted to accommodate only 2-hour sessions on account of the attendees' time-zoning. There was a trade-off between gains made on not having to travel, and keeping a sharp focus, versus losses of the amount of time available for each topic presentation and discussion. Delegates opted for a single shorter meeting across all time-zones rather than longer meetings split into a western and an eastern time-zone cluster. This was mainly to ensure discussion momentum was maintained and all delegates received and shared the same information. Requesting delegates to log-on early allowed us to minimise audio and other problems, and allowed people to greet in the virtual foyer

Delegates were welcomed by Dr Syafaruddin, Director ICECRD, Dr Jelfina Alouw, Executive Director of ICC, and Irene Kernot Horticultural Research Programme Manager ACIAR (also representing Christine Pahlman, Assistant Director, Agricultural Development and Food Security Section, Australian Department of Foreign Affairs and Trade (DFAT). ACIAR/DFAT are supporting COGENT's revitalisation, and their grant has made this meeting possible. ACIAR's director of Multilateral Engagement, Dr Julianne Biddle who is an SC observer member was also present.

Day1 linked to ICC Strategic plan and set the scene, explaining the new context, which is articulated in greater detail in COGENT's newsletter 1[10]. Day 2 provided space for International and National Coconut Genebank (ICG/NCG) representatives to briefly report on status (genebank appraisals pending) and flag important issues in discussion. Day 3 provided a forum for discussions linked to COGENT's four re-forming International Thematic Action Groups (ITAGs) in i) Ex Situ & In Situ Conservation ii) Genomics & Breeding iii) Phytopathology, Entomology & Germplasm movement and iv) In vitro culture & cryo-conservation. These groups will spearhead the implementation of COGENT's Global Strategy. Day 4 provided an update on the status of coconut germplasm data management and needs, and references to developing a sustainability plan for COGENT and the ICGs.

SC members endorsed suggested slight changes to the membership of just one representative per region, and after discussing the areas as listed above and in Annex 2, helped articulate the recommendations arising during the meeting for next steps, as articulated below.

Vincent Johnson, the Interim COGENT coordinator, and Dr Jelfina Alouw, the ED ICC would like to congratulate all the presenters and participants for a fertile and successful set of exchanges, that will help guide our common way forwards.

[10] https://coconutcommunity.org/regular/cogent_newsletter

SC (DRAFT) RECOMMENDATIONS 2020

The COGENT SC recommends that:

1 MEMBERSHIP

1.1 COGENT adds an alternative member representative for each of the 5 ICGs as follows: i) LAC- Brazil, **Dr Semíramis RAMOS**; II) AIO- Côte d'Ivoire, **Dr Tra Serges DOUBI** or **Dr Thierry THAKRA LEKADOU**; iii) SAME, India, **Dr Anitha KARUN**; iv) SEA-Indonesia, **Dr Stevie KAROUW**; v) SP- PNG, **Dr Carmel PILOTTI**

1.2 COGENT adds Dr Matija OBREZA, as an OBSERVER member representing the CropTrust

2 PLANNING MEETINGS

2.1 ICC formalises **monthly COGENT programme** meetings – third Wednesday of month (7 to 8 am CET) to include VJ, JA, MK, PB, CP, plus occasional presence of other regional reps (as potential assisting coordinators. Draft repeating agenda: proposals, ICGs, ITAG status, progress of ACIAR workplan, events (trainings conf workshops etc), sustainability plan

3 COCONUT GENEBANKS

3.1 In consultation with FAO-ITPGRFA, COGENT assists in **reviewing and renewing the Article 15- ICG hosting agreements** for all 5 ICGs. ITPGRFA will develop first draft letters to amend existing agreements (ICG-AIO and ICG-SP) , or to develop new agreements (ICG-SAME, LAC and SEA). An agreed draft will be shared with each host government contact in preparation for signature, along with FAO and ICC

3.2 COGENT formalises an **alternative representative for each ICGs** (see recommendation 1) to be responsible for transferring interesting accessions into ICG (all accessions available in one request)

3.3 COGENT facilitates **national coconut genebanks to develop international status** (e.g. the Philippines, Malaysia, Sri Lanka, Jamaica)

3.4 COGENT **finalises the ICG pre-appraisal visit questionnaire** in preparation for the remaining four ICG appraisal visits, and agrees visit dates, within the constraints of the COVID-19 pandemic, and COGENT finalises the ICG-SP appraisal report

3.5 ICG Curators and COGENT develop an **ICG and COGENT Sustainability Plan** that allows them to sustain themselves.

3.6 In conjunction with host country governments, ICG curators and COGENT develop a Genebank **Biosecurity Plan** that links to national biosecurity plans (if existing), and if not COGENT will liaise with the host to develop such a plan. Part of the plan will include a section on quarantine and phytosanitary responsibility and measures when receiving or donating germplasm and involving national quarantine agencies and certification mechanisms (ICC-COGENT can provide support but not certification, plus recipient country risk analysis). Special attention will be paid to auditing for lethal yellowing-like phytoplasma infestation, linked to effective diagnosis.

4 INTERNATIONAL THEMATIC ACTION GROUPS (ITAGS)

4.1 Nominated ITAG leaders **confirm their willingness to participate** and **review membership** , including settling the issue of leaders coming from COGENT member countries

4.2 ITAG leaders **convene and report on monthly virtual meetings** (and ad hoc physical meetings when events allow) to update on any progress in their field

4.3 ITAG leaders begin **formulating /developing their list of prioritised research idea/ projects** linked to the Strategy, to include support for ICC's coordinating role. ITAG1 will focus on ICG-related conservation management matters; ITAG 2 consolidating genomics and breeding links; ITAG 3 considering Biosecurity planning and conducting a survey/ review of (proven) diagnostic tools; ITAG 4 compile links to all TC and cryo protocols, provide snapshot of validation status to begin preparing for TC symposium and India Workshop. These priority projects will form the basis of renewed resource mobilisation/ proposal development.

4.4 Together, ITAG leaders contribute to developing the COGENT **Strategy implementation plan and budget.**

5 GERMPLASM DATA MANAGEMENT

COGENT takes steps to improve germplasm data management, including:

5.1 reviewing **data-sharing** restrictions, agreements, including soliciting advice from relevant bodies like ITPGRFA, Cirad and Bioversity-CIAT Alliance

5.2 review current **status of ICG and CGRD germplasm data**, and decide what needs updating/ re-collecting

5.3 organising a **timeframe and support for CGRD data migration**

5.4 organising **statistics and data-management capacity building** for member countries- linked to COGENT germplasm data-management training. This will be a possible collaboration with the Alliance of Bioversity and CIAT, Cirad, the CropTrust and the Integrated Breeding Management Platform for the Breeding Management System (https://bmspro.io/) (back-to-back with Malaysia COCOTECH meeting or other)

5.5 developing a **COGENT germplasm data management strategy**

Appendix 6: 21st Steering Committee Report

EXECUTIVE SUMMARY

A virtual COGENT SC meeting was held 13-15 October 2021.

The main meeting objectives were to:

1. Welcome Ms Erlene Manohar as the new COGENT Coordinator
2. Set the wheels in motion for finalising a Roadmap towards a self-sustaining COGENT
3. Discuss COGENT's activities to date and its agenda until the end of the ACIAR grant period (30 June 2022), and beyond.

Day 1 set the scene, and covered SC endorsements and brief updates on the International Coconut Genebanks (ICGs), including a) an overview of the ongoing ICG appraisals process and early findings, and b) presentations on germplasm data management. The status of the new Article 15 agreements, and highlighting the upcoming National Collections survey were also covered. Day 2 provided space for discussions linked to COGENT's four International Thematic Action Groups (ITAGs). These groups are spearheading the implementation of COGENT's Global Strategy, and delegates discussed how to optimise the ITAGs approach going forwards. COGENT's communications were also covered. Day 3 provided a forum for Day 4 provided an update on the status of coconut germplasm data management and needs, and references to developing a sustainability plan for COGENT and the ICGs. explaining the new context, which is articulated in greater detail in COGENT's newsletter 1.

Contents

1 Background and Rationale

Coconut is an important crop globally yet, despite the crop's vast potential, coconut farming is generally not a lucrative enterprise in the production sector. The diversity of this perennial crop is held as more than 1000 accessions, accounting for more than 420 distinct genotypes, in five international coconut genebanks[11] (ICGs) and 19 national coconut collections but which are are poorly conserved and underused. The International Coconut Genetic Resources Network (COGENT), with 39 coconut-growing countries as members was established in 1992[12]. COGENT has the mandate for coordinating efforts to conserve and promote greater use of coconut genetic resources. However, international support for COGENT has been dwindling, until ACIAR and DFAT provided renewed support for revitalizing the network in 2020, which has been hosted by the Jakarta-based International Coconut Community (ICC) since 2018. The recent arrangement aims to ensure technical support for the implementation of COGENT's recently formulated Global Strategy for Conservation and Use of Coconut Genetic Resources (the Strategy) and with the following deliverables.

9. A functioning and sustainable **COGENT Strategic Program**, supported by a financially capable ICC, with a designated full-time coordinator based at ICC, Indonesia, supported by the Secretariat of the Pacific Community (SPC), with an assisting coordinator based at SPC in Fiji, and support staff in Indonesia, with links to Asia, Africa and Latin America.
10. A doable **implementation workplan and budget** for the Global Strategy, highlighting links to the Pacific region. This deliverable will emanate from the four established **International Thematic Action Groups (ITAGs).** These group will be under responsibility of the COGENT Coordinator for strategy implementation with direct support of the ITAG leaders.
11. **Appraisal report of the coconut genetic resources** held in trust in the five multi-site International Genebanks (ICGs) and in the national collections of the 19 coconut growing countries, along with **recommendations for restoration and activation of the international multilateral system** and initial support for effective coconut germplasm exchange for utilization for the benefit of breeding prograMs This strategy intends to improve coconut productivity and linked livelihoods, across the Asia-Pacific and beyond.
12. **Provision of Income-generating components** and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

Having a fully functional COGENT that will play a pivotal role in ensuring the more effective conservation and use of coconut genetic resources, this will contribute to building coconut stakeholders' capacity and resilience across the value-chain. Current work will ensure that the capacity to conserve the genetic diversity of coconut is preserved and contributes to ACIAR's long-term program of work with the aim to rejuvenate the coconut industry in the Pacific.

COGENT has a Steering Committee (SC) composed of Chair and Vice-chair (the previous chair) plus voting regional representatives each from the five regions and an ICC representative, and observers from the international organisations. The SC provides policy and technical oversight. The SC traditionally meets biennially, back-to-back with the ICC COCOTECH meeting, but the COVID- 19 Pandemic constrained the face-to-face meeting, thus, 21st SC meeting is again held virtually.

[11] in Brazil, Côte d'Ivoire, India, Indonesia and Papua New Guinea.
[12] by the International Plant Genetic Resources Institute IPGRI- which became Bioversity International, and then part of the CGIAR Alliance of Bioversity & CIAT

2 MEETING OBJECTIVES

In summary, the main meeting objectives were to:

1. Welcome Ms Erlene Manohar as the new COGENT Coordinator
2. Set the wheels in motion for finalising a Roadmap towards a self-sustaining COGENT
3. Discuss COGENT's activities to date and its agenda until the end of the ACIAR grant period (30 June 2022), and beyond.

The Steering Committee meeting is a regular consultative activity of the committee members to discuss the status, developments, issues and concerns of the component groups of COGENT. The meeting is the venue for the SC members and the lead coordinators of the ITAGs and ICGs to present the challenges and progress of their respective activities in relation to the main purpose of COGENT as a research network in-charge of the global conservation of coconut genetic resources. In this meeting, conglomeration of relevant ideas, recommendations and prospects related to genetic resources conservation were tackled. The meeting set also the wheels in crafting the COGENTs Strategic Conservation Road Map or StratCORM towards a self-sustaining COGENT. Also in the meeting the COGENT's current activities and agenda until the end of ACIAR grant period on June 30, 2022 were threshed out.

At the end of the 3-day meeting, areas of concerns and way forward plans were harmonized for unified decisions in enhancing proposed strategies and come up with objective solutions and recommendations to address crucial problems raised during the meeting.

COGENT under the ICC programme held its second virtual online SC meeting between 13 and 15 October 2021. Over these three 2-3-hour daily sessions 55 coconut expert delegates (40% female) attended from 28 institutions spread across 21 countries spanning 12 time-zones from Mexico/ Brazil to Fiji/Australia (see annex 3). Most of the westernmost delegates had to attend at 5-7am and easternmost delegates at 22-24h, thus COGENT acknowledges participants' commitment attending each day, indicating high levels of engagement despite the time zone differences.

3 MEETING HIGHLIGHTS

3.1 DAY 1 HIGHLIGHTS

The first day of the meeting was the Introduction and welcoming of new COGENT coordinator, Ms Erlene C. Manohar from Philippines, the former Deputy Administrator of Research and Development of the Philippines Coconut Authority (PCA). She was warmly welcomed by ICC Executive Director Dr Jelfina Alouw and congratulated by the new Technical Working Group Chairperson, the current Administrator of PCA, also from Philippines, her former supervisor.

In opening the meeting, the outgoing interim COGENT coordinator Mr Johnson recapped the 2020 SC meeting recommendations on the following areas: COGENT Membership, Planning of Meetings, Coconut Genebanks (ICG and NCGs), the ITAGs (International Thematic Action Groups) and the improvement of the Germplasm Data Management System. These are also the focus of the 2021 SC meeting.

Mr Johnson also discussed the ACIAR grant progress focussing on the grant's key objectives for developing an ICG and COGENT sustainability plan and driving forwards its implementation. For the ICGs, there is an on-going consolidation and compilation of necessary documents and data for assessment. For ITAGs, he focused on ITAG leadership, membership, interactions and development of priority research projects in support of the ITAGs needs. He also presented the recruitment process of the new COGENT coordinator and proposed activities to explore other platforms in promoting COGENT functions such as webinars, website migration, and newsletters, etc.

Delegates were given an encouraging welcome by Dr Jelfina Alouw, Executive Director of ICC; Irene Kernot Horticultural Research Programme Manager ACIAR; Mr Benjamin Madrigal, Administrator of the Philippines Coconut Authority (PCA) and Dr Jean-Marc RODA, Cirad, SE Asia Islands Regional

Director, and (on Day 2) Dr Syafaruddin, Director ICECRD. Amongst the 55 stakeholders, Christine Pahlman, Assistant Director, Agricultural Development and Food Security Section, Australian Department of Foreign Affairs and Trade (DFAT), and ACIAR's director of Multilateral Engagement, Dr Julianne Biddle who is an SC observer member were also present. ACIAR/DFAT are supporting COGENT's revitalisation, and like last year, their grant has made this meeting possible.

After the formal addresses and introduction, Vincent Johnson listed the four elements requiring SC endorsement:

i) the **summary report and recommendations** arising from the **2020 SC meeting** (unanimously endorsed, but needing comparison with recommendations that arose from this meeting (see annex 1, for both sets of recommendations))
ii) the appointment of the **new COGENT Coordinator**
iii) the in-principle agreement to **publish the new Coconut Germplasm Guidelines** (developed and updated from the Stantech manual, but with the proviso of integrating any suggested additions, such as new categories of fruit colour (India))
iv) the general agreement of **appointed ITAG leaders** ICG-AIO (Cote d'Ivoire)

Mr Manzella (ITPGRFA) asserted that ICG appraisals must alert the responsible officers to the opportunities once the revised Article 15 agreements have been finalized. He reiterated that the responsible authorities must consider the amendment of the agreements in order to recognize the new role of ICC in the agreements.

After a presentation of the ICG appraisal outline, ICG curators presented challenges for their respective ICGs. But, prior to that Dr Jean Marc from CIRAD, highlighted germplasm being underutilized and suggested establishing a strong network to develop and promote biodiversity. He pledged CIRAD's active participation and involvement in strengthening the coconut biodiversity conservation. He also emphasized that CIRAD is developing its own coconut research roadmap to be implemented from January 2024. The new coordinator Ms Manohar added that in the Philippines all planting materials have to be registered considering their wide-ranging coconut germplasm collection and currently, with 263 accessions according to Mr Ramon Rivera from Philippines.

3.1.1 ICGs Presentations

1. <u>Côte d' Ivoire (CNRA)- ICG for Africa and the Indian Ocean (ICG-AIO)</u>

For the first ICG-AIO in Cote d' Ivoire Mr Johnson presented the appraisal with the current 127 accessions, 30 to 50 palms per accession. The collection is not well-maintained due to budget constraints. The rejuvenation program was stopped in 2012 when more than 16 Tall accessions had become too tall for accessing the inflorescences for research and development purpose. Controlled pollination and open pollination were used in the conduct of regeneration program.

Key concerns include Lethal Yellowing Disease (LYD) and land pressure that constrain accessions duplication. COGENT's technical support is recommended for developing coconut mapping. ICG-AIO requests more training, equipment and developing an effective data collection and management system. especially focussing on young researchers.

2. <u>Brazil (EMBRAPA)</u>

Dr Marcelo Fernandes, Deputy Chief of R&D Embrapa (Brazil) presented the status of their general genebank management level. He reported that the dwarf and tall coconut accessions are in excellent and good condition, respectively, although some tall accessions in Betume are suffering. All accessions are well maintained and as of now, no regeneration method yet. However, there is a plan to use controlled pollination for *Tall* accessions rejuvenation. For the major challenges being faced in their area are the regeneration of tall coconut accessions conserved at Betume Experimental Field. ICG-LAC also aims to enrich its collection by introducing other accessions (LYD-tolerant materials). They also are aiming to expand funding for germplasm conservation and regeneration

3. <u>India ICG (ICF-SAME)</u>

Ms Niral Vittal who is a breeder and ICG curator from ICAR – Central Plantation Crops Research Institute (ICAR-CPCRI) presented the status of the ICF-SAME ICG. Accessions from the host country are controlled through pollination. There are 74 accessions with developed descriptors and identified genomics of Chowgat Green Dwarf. For the challenges and issues, she mentioned the need to broaden coconut's genetic base across COGENT member countries. She also reported that collection from Indian Ocean Islands have very few palms and needs funding to enhance population size. Similarly, she stressed the need for training on updating and utilization of the coconut genetic resources database.

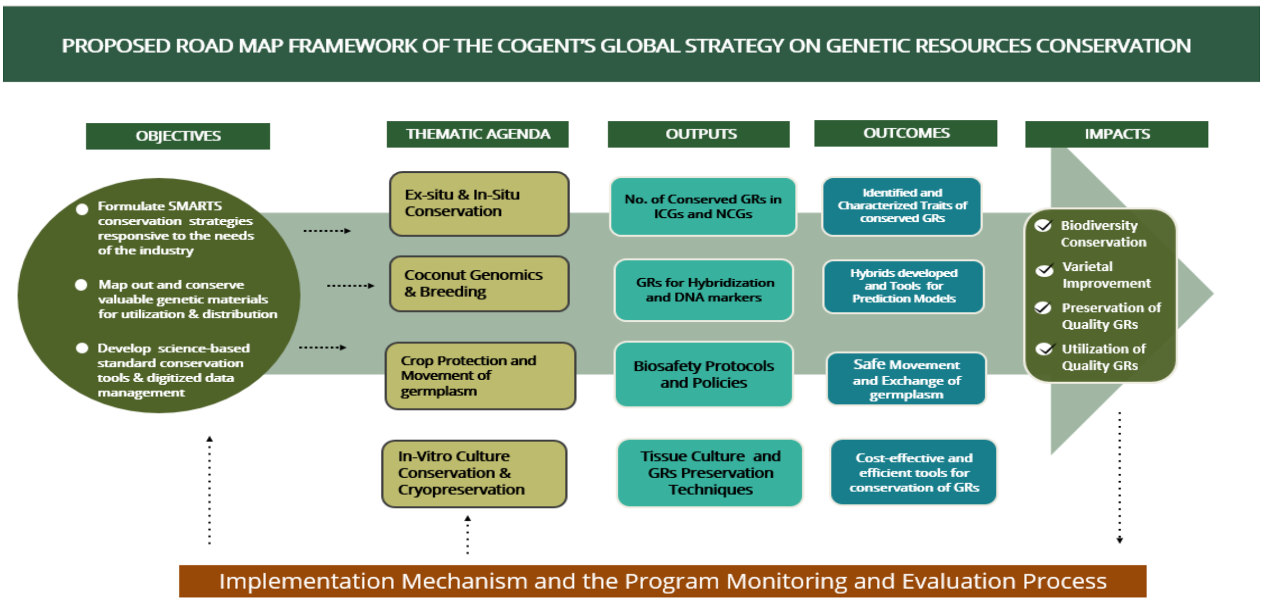
4. <u>Indonesia ICG (SEA)</u>

The ICG appraisal was presented by Ms Meity Tulalo presented the status of ICG-SEA-Indonesia. Accordingly, all accessions (12-20 years of age) are well-maintained. The regeneration of accessions used the hand pollination in the selection of mother palms. At present, no sharing of accessions yet. She highlighted the difficulties associated with introducing germplasm from other member countries. She suggested creating database software to monitor morphometric and molecular marker characterization. She also added as recommendation to establish a tissue culture molecular laboratory and to further build the capacity of researchers.

5. <u>Papua New Guinea ICG (South Pacific)</u>

The ICG-SP is currently being relocated to avoid the ongoing threat of Bogia Coconut Syndrome. Mr Eremas Tade, the ICG curator presented that there are 41 tall accessions and 12 dwarfs conserved in ICG-SP (26-27 years old) and all healthy with little BCS infection and CRB damage with well-maintained buffer zone. However, no regeneration methods used and no accession sharing so far. He also reiterated the lack of tissue on the past 10 years and data collection and storage. Moreover, he stressed that COVID-19 affected the progress of relocation of the genebank. In the same manner that collection of coconut accessions from original sites are on hold.

Figure 1. Proposed Roadmap Framework of the COGENT's global strategy on genetic resources conservation



3.1.2 Overall discussion on ICG status, needs and recommendations

Almost all ICG presentations highlighted the problem of inefficient germplasm exchange, which is connected to policy agreements. In most cases of conservation (for any crop), biosecurity and pest and disease problems are barriers to exchanging genetic resources. It is thus necessary to review the protocols in relation to these risks. In the case of Côte d' Ivoire and Papua New Guinea, the sustainable resources to support maintenance and rejuvenation need to be prioritized. Furthermore, a succession plan is needed that also includes recruiting and training junior technical staff. Additionally, mitigating measures to address the impact of climate change need to be developed and implemented within the COGENT strategy. Given such challenges and needs of the ICGs, comprehensive assessment and prioritization of critical activities of the conservation program need to be put in place. Needless to say, as presented in the meeting, the present database management system has to be upgraded using a digitized platform. To compliment such action building the capacity of curators through CGRD training. Given all of these issues and concerns, COGENT must effectively mobilize resources to ensure sustainability of activities needed to effectively conserve genetic resources. A set of possible recommendations, broken down by ITAG has been extracted from the meeting exchanges which is provided in the annexes.

3.2 DAY 2 HIGHLIGHTS

Dr Syafaruddin, Director of ICECRD (Indonesian Center for Estate Crops Research and Development), welcomed everyone during the opening of the 2nd day. His inspiring message reaffirmed his commitment to support the ICC towards the further development of the coconut industry. Moreover, he mentioned that ICECRD is developing a database that can provide valuable information on crops like coconut, cacao, coffee, etc. that will be accessible to everyone from anywhere using only mobile phones.

The meeting continued for the presentation of the status of projects of the ITAGs. Presenters provided the current situation in their thematic area and discussed the challenges they face. Also, they have proposed recommendations on how COGENT may address their issues and concerns.

3.2.1 ITAG PRESENTATIONS

1. ITAG 1 - Ex Situ and In Situ Conservation
   Presented by Dr Ehsan Dulloo, ITAG 1 leader and Senior scientist within the Alliance of Bioversity International and CIAT

   Dr Ehsan Dulloo presented the status of ITAG1 projects. He highlighted limited germplasm exchange. However, there is still a desire to increase genetic diversity of coconut collections which will be addressed as soon as COVID restrictions are relaxed. He also mentioned there has been no regeneration in most ICGs, and for *Tall* types this is due to increasing palm height.

   Their group identified priority areas that need to be addressed immediately which includes securing priority threatened accessions, improving genebank management including regeneration, data management of CGR using GRIN (global database management system), germplasm exchange between genebanks, capacity building training, resource mobilization, and crafting of Genebank Sustainability Plan.

   After discussing ITAG1 issues and concerns, he presented recommendations on how these may be addressed. He has proposed conducting webinars relating to specific ITAGs, active fund-raising to support the ITAGs work, and encouraging active young coconut genetic scientists as ITAG members.

2. ITAG 2 - Coconut Genomic and Breeding
   Presented by Dr Yaodong Yang, ITAG 2 leader, CRI-CATAS China

Dr Yang highlighted the importance of pan-genomic studies as a single reference genome is not enough. The analysis using a genome as a template cannot fully reflect all genetic information at the gene-level of a species, hence the need of pan-genomic studies. Furthermore, the population evolution of coconuts and discovery of novel genes may be elucidated through a technology roadmap for coconut pan-genomics study

Mr Johnson mentioned that the pan-genomic study proposal had already been re-submitted to the Chinese government and rejected. It will be resubmitted in January 2022. Dr Yao assured participants that the team is still working on the project to further develop the sequencing of accessions

Dr Roland Bourdeix shared his opinion on reviving damaged population of coconuts. He mentioned that it's too late to rejuvenate damaged palMs Even with fertilization, it might be considered a waste of resources. The palms may survive but the evaluation of the farm might be compromised. However, Dr Jean Marc's opinion says otherwise. Himself as an agronomist believes that every palm with any chance of recovery shall be retrieved.

3. ITAG 3 - Phytopathology, Entomology & Germplasm movement
Presented by Dr Wayne Marie, ITAG 3 leader

He presented the challenges in production which includes pest and diseases, increase in production cost, availability of good quality seedlings, safe movement of germplasm and impact of climate change. He stated that ITAG 3's objective is to develop a coherent set of research projects that address the highest priorities in effective safe and healthy germplasm movement and sources of clean and affordable planting material.

Their team had submitted two project proposals – (1) DIGICOCO: Smart Pest-Control Innovations for Small-Scale Coconut Producers sent to Gates Foundation with US$1.5 million as the proposed funding and (2) HOLISTICOCO: Increasing yields for small-scale coconut producers in Africa through an integrated crop health, production and extension systems sent to GIZ Innovation Challenge with US$150,000 as the proposed funding. However, these two proposals were rejected. Nevertheless, they are still improving these researches and hoping to get funding soon.

4. ITAG 4 - In Vitro Culture and Cryoconservation

Presented by Dr Anitha Karun, ITAG 4 leader, Director of ICAR-CPCRI

Dr Karun stated that their main objective is to refine and validate the current tissue culture and cryoconservation protocols in coconut. The validation of laboratory protocols of coconut tissue culture and cryoconservation and research optimization for scaling up are the mentioned researchable issues. As for the proposed strategies, she mentioned the need of large-scale selection of priority varieties linked to effective nursery management and replanting programmes, hybridization of priority varieties for precocity, productivity, tolerance to abiotic and biotic stresses, and supporting national replanting programmes and area expansion

After presentation of the ITAGs, Dr Carlos presented a brief on the proposed International Symposium on Coconut Tissue and Cryopreservation. Once the restrictions are lifted and the safety protocols are established, the plan is to hold the symposium in Merida, Mexico on May 2022.

3.3 DAY 3 HIGHLIGHTS

For the 3rd day of the meeting Vincent Johnson solicited the thoughts of the participants on the issue of membership. According to him, at present there are 17 members countries of ICC. countries of COGENT are also members of ICC. Since COGENT is already a part of ICC, there is a need to discuss the membership arrangement on the two networks. Currently, there are 39 members of COGENT and most of them are inactive. He suggested to hold a virtual meeting to strategize on how to engage the members for active participation. Vincent Johnson solicited the opinion of Ms Erlene Manohar and in response she is the idea that there is need to expand the membership to have an active and sustainable network. This will allow all member countries to support each other especially the ones with low production and just starting to develop the coconut industry in their respective country. Another issue that Mr Johnson reiterated is the proposition to revitalize the designation of chair and co-chair of COGENT which was deferred for the meantime.

Further, Mr Johnson stressed that an active and strong research network is vital in revitalizing the coconut genetic industry. There is a need to have close coordination and partnership with the private sector and farmers welfare should be prioritized. The idea is to link the ICC to the private sector then connect it back to COGENT for harmonization. At this point, Dr Jelfina Alouw reiterated that support to member countries is the main priority. Showcasing the benefits of being a member country will encourage non-members to apply for membership. Ms Erlene Manohar added that research must be prioritized because it is the foundation of development. There should be conduct of webinars and seminars to attract more scientists into engaging in coconut genetic research. Further, she mentioned that linking research activities to various institutions provides a significant leverage especially in building connections to the private sectors. This will establish the ICC's image globally that may attract fundings from various institutions.

Communications were also discussed in terms of newsletter and website updates.

3.4 Strategic Conservation of Road Map (StratCORM)

Prior to Ms Erlene Manohar's presentation on the way forward of COGENT, she first discussed the synthesis of the 2-day meeting. She summarized the key challenges to address by the Coconut Conservation program of COGENT well as the proposed strategies and recommendations on how to address these identified problems and she mentioned that these can utilized as inputs in the crafting of the Strategic Conservation of Road Map (StratCORM- see figure 1).

As for the crafting of the roadmap, Mrs. Manohar discussed the proposed COGENT DEVELOPMENT OF A ROADMAP FOR SUSTAINABLE GLOBAL CONSERVATION AND USE OF COCONUT GENETIC RESOURCES. The roadmap will set the direction and be the basis of strategic management in developing an inclusive and expanded coconut genetic network. She highlighted her priority thoughts as the COGENT coordinator which is strengthening COGENT's role in helping develop a responsive and sustainable coconut industry, globally supported by COGENT's thematic areas of concern. She emphasized that there should be a comprehensive assessment of the activities and programs through a SWOT Analysis. Assessing the status of the ICGs and the ITAGs program has to be a priority activity to be able to set the basis in aligning the recommendations. It is for this reason that the Road Map should be able to a) identify the challenges and align the strategies 2) generate measurable impacts of the strategies and gains of the member countries 3) assess the outputs and harmonize the plans. It is expected that the Road Map shall serve as guide for the planners and decisionmakers in the formulation and prioritization of strategies. With the Road Map, it is imperative to establish a unified direction towards a clear VISION of the COGENT's Strategic Plan. The Road

Map will be a game changer to revitalize COGENT with the support of ICC, donor agencies and member countries.

As mentioned by, the Road Map features practical and effective initiatives for conserving genetic resources globally for utilization and biodiversity protection. This StratCORM has to be supported through a cohesive thematic agenda and with sustained support from COGENT member countries and potential donor institutions. In the presentation, Ms Manohar pointed out that StratCORM provides a clear a framework (Fig 1.) with identified major OBJECTIVES linked to the thematic agenda as inputs to address the achievement of the desired OUTPUTS. She also mentioned that this draft framework is anchored within the Strategic Global Plan and this Road Map provides channel to guide the operationalization of the plans with indicators of OUTCOMES and IMPACTS. She further explained that once this framework is agreed upon with the inputs of the members, projects and activities and the expected timelines will be in accordance with this framework. In the same manner that the implementation scheme shall be guided accordingly with the corresponding monitoring and evaluation mechanism to ensure that the directions are all geared towards achieving goals for conservation, protection and utilization of the coconut genetic resources.

To further provide a clear concept of StratCORM, she presented the connectivity of the chain of thematic areas as COGENT's platform for conserving and using genetic resources. The CONSERVATION as the inputs, of which the thematic initiatives as the basis of the ITAGs planning. She also highlighted the ITAGs' interconnectivity which should complement and synergise with plans for a one-COGENT agenda. As such, the Road Map will steer the planning process with identified measurable indicators of the strategies towards achieving COGENT's overall goal of effective and sustainable conservation of genetic resources, biodiversity protection and its utilization for coconut industry growth in the global perspective where benefits are equitably shared among member countries.

She also provided her insights on the current priority challenges that need to be addressed:

1. The current situation of the multi-site genebanks in Papua New Guinea, India, Indonesia, Côte d'Ivoire and Brazil needs to be greatly improved.
2. Coconut conservation has to help address the poverty of coconut farmers, since they are reluctant to conserve indigenous varieties.
3. For in-situ conservation, investment in new technologies is not a priority for ordinary farmers.
4. The lack of attention by policy makers for addressing the problems of the coconut production sector and lack of interest in providing support for coconut conservation despite the major contribution of coconut to the economy of many coconut-producing countries.
5. Coconut farming is perceived as unprofitable, hence there is little interest in supporting coconut GR conservation. The value chain should harness opportunities to ensure profitability.
6. There is limited policy support and inadequate resources for sustainability of the ICGs and NCGs.

She also mentioned that with such challenges as presented by the ICGs and ITAGs, key strategies were identified and priority actions need to be taken. These strategies can be incorporated within the StratCORM, as initial efforts to come up with valid and problem-focused approaches. In the Road Map addressing the existing challenges is topmost priority prior to new schemes. Hence, she presented key strategies based on the previous appraisal of the challenges presented by the ICG curators of and ITAG leaders. These key strategies addressing the major challenges are relevant in the development of the Road Map to be able to determine the significance of these initiatives. Through this process, effective setting of directions shall be based on benchmark data and issues clarified during consultations with the concerned groups/teams responsible in these key conservation areas. Well-defined concerns are vital in this Road Map which will need cooperation among member countries, the ICGs and ITAGs.

As presented, these are the key strategies that were recommended to the Steering Committee that needs their concurrence.

1. Revisit the status and proposed outcomes of the ICGs and promote the intended impact to coconut member countries in terms of germplasm utilization.

2. Mainstream coconut farmers in the in-situ conservation process in addressing the erosion of coconut diversity by providing income-generating interventions focusing on the valuable uses of high-value germplasm.
3. Encourage on-farm expansion and distribution of identified high-value genetic resources to serve as sources of quality planting materials and for use as parent material in hybridization programs.
4. Provide incentivized farmer-participatory coconut planting of high-value genetic resources through national country programs
5. Promote cooperation within and between member countries in coconut germplasm conservation and exchange programs focusing on high-value genetic resources with strategic distribution to balance supply and market demand among member countries.
6. Propose R & D conservation projects on these thematic areas to address the challenges and provide science-based information and technical assistance to member countries of COGENT.
7. Develop a comprehensive proposal and practical germplasm conservation program from prospection, identification, formulation of techniques, distribution, promotion and utilization responsive to evolving market demand of different high-value coconut products.
8. Offer policy advocacy for conservation of genetic resources (i.e., biosecurity, germplasm exchange, certification, phytosanitary concerns).

For her last slide she provided the template and vital components of the proposed StratCORM, that can be used also by each ITAG for their respective Road Maps. In addition, she proposed an action plan for the development of inclusive and responsive Road Map for conserving and utilizing coconut genetic resources as major component for industry development.

3.5 CONCLUDING REMARKS

The members lauded the presentation of the proposed roadmap and pledged to actively support its development and objectives on the way to go as far as the conservation of genetic resources is envisioned to achieve an efficient and sustainable protocols for conservation.

Vincent Johnson, the Interim COGENT coordinator, and Dr Jelfina Alouw, the ED ICC congratulated all the presenters and participants, and for a fertile and successful set of exchanges, that will help guide our common way forwards.

4 ANNEXES

4.1 Annex 1: SC 2021 Meeting draft recommendations

1 COGENT strategy alignment

1.1 Align COGENT's strategy with that of ICC. The ICC strategy is efficiently orientated towards consumers and processors. To be fully coherent, the COGENT strategy should be complementary to that of the ICC. Thus, it will focus mainly on national and international research institutions, international organizations, farmers, decision-makers and to a lesser extent to landscapers and the tourism industry

2 Collaboration

2.1 Encourage greater cross collaboration between ITAGs and among member countries and host countries.

2.2 Develop the framework for interactions between ITAGs, including ratifying ITAGs TORs

2.3 Revive the consideration of having a "double headed" ITAG leadership with 1 senior/1 junior expert.

3 **ITAG1**

3.1 Establish an ongoing Treaty dialogue with NCGs

3.2 Harmonise ICG & NCG collections' interactions

3.3 Facilitate duplication of priority accessions

3.4 Facilitate drones' use in ICG appraisals and management

3.5 adoption of GRIN-Global as it supports SMTA reporting and DOI assignation

3.6 Facilitate effective germplasm data management system including appropriate software / database and training via data workshops

3.7 Help design a barcode-based traceability system in ICGs and NCGs

3.8 Fully promote the multi-facets of coconut diversity and facilitate returning this diversity to seedling producers and to farmers, to make need COGENT more responsive to emerging needs of coconut growers/stakeholders.

3.9 SC must endorse new coconut germplasm characterisation guidelines (from Darwin Project)

3.10 Include fruit colour as part of new characterisation guidelines

3.11 Prioritise characterisation of needed / useful accessions, for added value

4 **ITAG 2**

4.1 collection and management fit to the challenges of genomic breeding

5 **ITAG 3**

5.1 Help develop biosecurity protocols especially to contain most threatening pests and diseases such as LYD and Coconut Lethal Crown Atrophy (Brazil)

5.2 Support developing germplasm exchange policies that remove exchange bottlenecks.

5.3 Support optimising axillary shoot multiplication TC protocol to facilitate transfering healthy material through genebanks and safeguarding accessions.

5.4 Facilitate appropriate regular monitoring and certification of accessions against pests and disease contamination COGENT is not a certification body, but may decide to issue statements regarding disease-free material, although any such a document does not replace any phytosanitary certification that may be required in accordance with applicable laws. Further disclaimers may also be necessary.

5.5 Ensure stronger linkages with all the ITAGs regarding safe germplasm movement

6 **ITAG 4**

6.1 Support optimizing axillary shoot multiplication TC protocol and others where appropriate

6.2 Solicit evidence from CICY on success of SE TC protocol

6.3 Develop and hold international symposium,

7 **Communication strategy**

7.1 A communications strategy should be developed and include increasing and improving the scientific content on COGENT's website.

4.2 Annex 1: SC (DRAFT) RECOMMENDATIONS 2020

The COGENT SC recommends that:

1 MEMBERSHIP

1.1 COGENT adds an alternative member representative for each of the 5 ICGs as follows: i) LAC- Brazil, Dr Semíramis RAMOS; II) AIO- Côte d'Ivoire, Dr Tra Serges DOUBI or Dr Thierry THAKRA LEKADOU; iii) SAME, India, Dr Anitha KARUN; iv) SEA- Indonesia, Dr Stevie KAROUW; v) SP- PNG, Dr Carmel PILOTTI

1.2 COGENT adds Dr Matija OBREZA, as an OBSERVER member representing the CropTrust

2 PLANNING MEETINGS

2.1 ICC formalises monthly COGENT programme meetings – third Wednesday of month (7 to 8 am CET) to include VJ, JA, MK, PB, CP, plus occasional presence of other regional reps (as potential assisting coordinators. Draft repeating agenda: proposals, ICGs, ITAG status, progress of ACIAR workplan, events (trainings conf workshops etc), sustainability plan

3 COCONUT GENEBANKS

3.1 In consultation with FAO-ITPGRFA, COGENT assists in reviewing and renewing the Article 15- ICG hosting agreements for all 5 ICGs. ITPGRFA will develop first draft letters to amend existing agreements (ICG-AIO and ICG-SP) , or to develop new agreements (ICG-SAME, LAC and SEA). An agreed draft will be shared with each host government contact in preparation for signature, along with FAO and ICC

3.2 COGENT formalises an alternative representative for each ICGs (see recommendation 1) to be responsible for transferring interesting accessions into ICG (all accessions available in one request)

3.3 COGENT facilitates national coconut genebanks to develop international status (e.g., the Philippines, Malaysia, Sri Lanka, Jamaica)

3.4 COGENT finalises the ICG pre-appraisal visit questionnaire in preparation for the remaining four ICG appraisal visits, and agrees visit dates, within the constraints of the COVID-19 pandemic, and COGENT finalises the ICG-SP appraisal report

3.5 ICG Curators and COGENT develop an ICG and COGENT Sustainability Plan that allows them to sustain themselves.

3.6 In conjunction with host country governments, ICG curators and COGENT develop a Genebank Biosecurity Plan that links to national biosecurity plans (if existing), and if not COGENT will liaise with the host to develop such a plan. Part of the plan will include a section on quarantine and phytosanitary responsibility and measures when receiving or donating germplasm and involving national quarantine agencies and certification mechanisms (ICC-COGENT can provide support but not certification, plus recipient country risk analysis). Special attention will be paid to auditing for lethal yellowing-like phytoplasma infestation, linked to effective diagnosis.

4 INTERNATIONAL THEMATIC ACTION GROUPS (ITAGS)

4.1 Nominated ITAG leaders confirm their willingness to participate and review membership, including settling the issue of leaders coming from COGENT member countries

4.2 ITAG leaders convene and report on monthly virtual meetings (and ad hoc physical meetings when events allow) to update on any progress in their field

4.3 ITAG leaders begin formulating /developing their list of prioritised research idea/ projects linked to the Strategy, to include support for ICC's coordinating role. ITAG1 will focus on ICG-related conservation management matters; ITAG 2 consolidating genomics and breeding links; ITAG 3 considering Biosecurity planning and conducting a survey/ review of (proven) diagnostic tools; ITAG 4 compile links to all TC and cryo protocols, provide snapshot of validation status to begin preparing for TC symposium and India Workshop. These priority projects will form the basis of renewed resource mobilisation/ proposal development.

4.4 Together, ITAG leaders contribute to developing the COGENT Strategy implementation plan and budget.

5 GERMPLASM DATA MANAGEMENT

5.1 COGENT takes steps to improve germplasm data management, including:

5.2 reviewing data-sharing restrictions, agreements, including soliciting advice from relevant bodies like ITPGRFA, Cirad and Bioversity-CIAT Alliance

5.3 review current status of ICG and CGRD germplasm data, and decide what needs updating/ re-collecting

5.4 organising a timeframe and support for CGRD data migration

5.5 organising statistics and data-management capacity building for member countries- linked to COGENT germplasm data-management training. This will be a possible collaboration with the Alliance of Bioversity and CIAT, Cirad, the CropTrust and the Integrated Breeding Management Platform for the Breeding Management System (https://bmspro.io/) (back-to-back with Malaysia COCOTECH meeting or other)

5.6 developing a COGENT germplasm data management strategy

4.3 Annex 3: FINAL LIST OF PARTCIPANTS CONFIRMED FOR MEETING

Country	Institution	Post	First Name	FAMILY NAME	Email
Australia	UQ	ITAG-Member	Steve	Adkins	s.adkins@uq.edu.au
PNG	Kokanas Indastri Koporesan (KIK)	ICG-SC member	Alan	AKU	aaku@kik.com.pg; aakualan@gmail.com
Indonesia	ICC	ED, Welcome Speech	Jelfina	Alouw	jelfina@coconutcommunity.org
Philippines	Chairman, ICC Technical Working Group	ICC	Pons	Batugal	pbatugal@gmail.com
France	Bioversity	ITAG-Member	Luc	Baudouin	luc.baudouin@cirad.fr
Australia	ACIAR	Non-Voting SC member	Julianne	Biddle	Julianne.Biddle@aciar.gov.au
France	CIRAD	ITAG-Member	Roland	Bourdeix	roland_bourdeix@yahoo.fr ;
Brazil	EMBRAPA	ICG-SC Member	Emiliano	Costa	emiliano.costa@embrapa.br
Italy	FAO	Invited Guest	Stefano	Diulgheroff	Stefano.Diulgheroff@fao.org
Ivory Coast	CNRA	ITAG-Member	Bi Tra Serges	Doubi	doubitraserge@yahoo.fr; doubitraserge@gmail.com
Mauritius	Bioversity	ITAG Leader	Ehsan	Dulloo	e.dulloo@cgiar.org
Italy	Plant Genetic Resources and Seeds (AGPMG)	Non-Voting SC member	Bonnie	Furman	Bonnie.Furman@fao.org
Indonesia	CIFOR-ICRAF	SC Member-Non voting	Vincent	GITZ	v.gitz@cgiar.org
Malaysia	Ministry of Agriculture; Department of Agriculture	NG-ITAG Member	Christopher	John Biai	christopherjb@doa.gov.my
France	Alliance of Bioversity International and CIAT	Interim Cogent Coordinator	Vincent	Johnson	v.johnson@cgiar.org
India	Central Plantation Crops Research Institute (CPCRI)	ITAG Team Leader	Anitha	KARUN	anitha.karun@icar.gov; anithakarun2008@gmail.com
Australia	ACIAR	Speech	Irene	Kernot	irene.kernot@aciar.gov.au
Côte d Ivoire	Centre National de Recherche Agronomique (CNRA)	ICG-SC Member	Jean Louis	KONAN KONAN	konankonanjeanlouis@gmail.com
Indonesia	ICC	ITAG-Member	Mridula	Kottekate	mridula@apccsec.org
Philippines	PCA	ITAG-Member	Kristi	Kueto	cacueto@yahoo.com; kristicueto@gmail.com

Country	Institution	Post	First Name	FAMILY NAME	Email
Italy	ITPGRFA	Non Voting SC member	Daniele	MANZELLA	daniele.manzella@fao.org
Indonesia	Indonesian Agency for Agricultural Research & Development (IAARD)	ITAG Member	Ismail	Maskromo	ismailmaskromo2010@gmail.com
Tanzania	TARI	Vice chair COGENT	Deusdedith	Mbanzibwa	mbanzibwad@yahoo.co.uk
India	CPCRI-	ITAG-Member	Rajesh	MK	mkraju_cpcri@yahoo.com
Jamaica	CIB	ITAG Leader	Wayne	Myrie	waynemyrie@hotmail.com
Vietnam	Vietnam University	ITAG-Member	Quang	Nguyen	quang.nguyen212@gmail.com
Indonesia	Indonesian Agency for Agricultural Research & Development (IAARD)	ICG-SC Member & ITAG Member	Hengky	Novarianto	hengkynovarianto@yahoo.com
Mexico	CICY	ITAG-Member	Carlos	Oropeza	carlosmos@yahoo.com; coscicy@gmail.com
Australia	DFAT	Speech	Christine	Pahlman	christine.pahlman@dfat.gov.au
Sri Lanka	Coconut Research Institute (CRI)	NG-ITAG Member	Lalith	Perera	lalithperera1234@yahoo.com
France	Bioversity	ITAG-Member	Fabien	Pilet	fabian.pilet@cirad.fr
Fiji	SPC	SC Member-Non-voting & ITAG Member	Carmel	Pilotti	carmelp@spc.int
France	Cirad	Non-Voting SC member	Alexia	PRADES	alexia.prades@cirad.fr
Brazil	EMBRAPA	ITAG-Member	Semiramis	Ramos	semiramis.ramos@embrapa.br
Philippines	Philippine Coconut Authority (PCA)	NG-ITAG Member	Ramon	Rivera	rlrivera_pca@yahoo.com.ph
Indonesia	ICECRD	Director, For Introductory Speech	Syafaruddin	Syafaruddin	den_ovan@yahoo.com

Country	Institution	Post	First Name	FAMILY NAME	Email
PNG	Kokanas Indastri Koporesan (KIK)	ICG-SC member	Eremas	Tade	eremast@yahoo.com.au; dreremas.tade@gmail.com
India	Central Plantation Crops Research Institute (CPCRI)	ICG-SC Member & ITAG Member	Niral	Vittal	niral.v@icar.gov.in; niralv@yahoo.com
Italy	Bioversity	Invited Guest	Stephen	Weise	s.weise@cgiar.org
China	CRI	ITAG-Member	Yaodong	Yang	yyang@catas.cn
Indonesia	Bogor University	ITAG Leader	Sudarsono		sudarsono_agh@apps.ipb.ac.id sudarsono.ipb@gmail.com

4.4 Annex 4: Meeting Agenda

Day	Date	period	cumulative			CEST		Activity area	Activity detail	who	comments
		mins	mins	hrs	mins/day	start	fin				
Weds	13-Oct	5	5	0.1	5	12:00	12:05	agenda	quick introduction to Agenda	VJ	
		5	10	0.2	10	12:05	12:10	Welcome	Formal welcome address	Jelfina Alouw, ED ICC	short speech
		5	10	0.2	10	12:10	12:20			Irene Kernot (IK) ACIAR	short speech
		10	20	0.3	20	12:20	12:30	Introductions	Introductions (New participants only) COGENT Coordinator, Erlene Manohar, Others- Cirad regional director)	Vincent Johnson (VJ), Outgoing COGENT Coordinator	short intro- introductions in presentations inaugurating Erlene (plus PCA Admin B. Madrigal)
		5	25	0.4	25	12:25	12:35	welcome	Formal welcome address	Dr Jean-Marc RODA, Cirad SE Asia Islands Regional Director	short speech
		15	40	0.7	40	12:40	12:50	COGENT Planning	SC endorsements: 2020 meeting minutes/ resolutions ; New germplasm Characterisation Guidelines; new Coordinator; other COGENT changes	All	
		5	45	0.8	45	12:45	12:55		Overview of ACIAR revised workplan and progress	VJ	with refs to Newsletter 2/ annual report
		5	50	0.8	50	12:50	13:00	ICG matters	ICG appraisals status and schedule,	VJ	plus pre-visit questionnaire presentation
		5	55	0.9	55	12:55	13:05		National collections survey (discuss the approach)		
		5	60	1.0	60	13:05	13:10		New Article 15 Tripartite agreements- current status	Daniele Manzella, ITPGRFA	short presentations with focus on any success stories, and serious challenges
		5	65	1.1	65	13:10	13:15		ICG-AIO (Cote d'Ivoire)	Jean Louis Konan Konan, CNRA	
		5	70	1.2	70	13:15	13:20		ICG-LAC (Brazil)	Emiliano Costa, EMBRAPA	
		5	75	1.3	75	13:20	13:25		ICG-SAME (India)	Niral Vittal, CPCRI,	
		5	80	1.3	80	13:25	13:45		ICG-SEA (Indonesia)	Stevie Karouw, Balit Palmae	
		5	85	1.4	85	13:45	14:30		ICG-SP (PNG)	Eremus Tade/Alan Aku, KIK	
		20	105	1.8	105	13:45	14:30		Overall discussion on ICG status and needs	all	discussion
		40	145	2.4	145	14:30	15:20		Germplasm data management (CGRD/training /needs/ next steps)	Moderated discussion	possibly panel with Roland Bourdeix/ Luc Baudouin, Chantal Hamelin (Cirad), Jean Marc Ribaud (BMS), ; Max Ruas (CGIAR Alliance)CropTrust
		10	155	2.6	155	15:20	15:30		Day 1 Action points for COGENT planning-recommendations and next steps	all	discussion to produce recommendations
Thur	14-Oct	10	10	0.2	10	12:00	12:10	ITAG matters,	Preamble on ITAG progress, proposals pipeline	VJ	group discussion-including scope & outlining & harmonising priority projects per ITAG based on presentations; Resource mobilisation targets (based on priority projects)- idea for ITAG webinars on priority areas. Plus how to make ITAGs more effective/ compensation for leaders
		10	20	0.3	20	12:10	12:20		1.*Ex Situ* & *In Situ* Conservation -ITAG 1	Ehsan Dulloo, Biov-CIAT Alliance	
		10	30	0.5	30	12:20	12:30		2. Genomics & Breeding -ITAG 2	Yaodong Yang, CATAS, China (Ramon/other PCA)??)	
		10	40	0.7	40	12:30	12:40		3. Phytopathology, Entomology & Germplasm movement ITAG 3	Wayne Myrie, CIB, Jamaica	
		10	50	0.8	50	12:40	12:50		4. In vitro culture & cryo conservation ITAG 4 (TC&Cryo) including TC training and symposium	Anitha Karun, CPCRI, India/ Carlos Oropeza CICY	
		30	80	1.3	80	12:50	13:30		How to approach ITAGs going forwards?	all / moderated by VJ	
		15	95	1.6	95	13:30	13:40	communications	COGENT coommunications -website, newsletter, technical papers, monthly webinar series	VJ/all	discussion on best approach to update
		10	105	1.8	105	13:40	13:50		Day 2 Action points for ICG-recommendations and next steps	all	discussion to produce recommendations
Fri	15-Oct	10	10	0.2	10	12:00	12:10	COGENT membership	COGENT Membership discussion and Chair/ vice chair nominations	all	should this be separate from ICC membership? a subset? about non-ICC members becoming ICC members, how to engage all 39 member countries AGM after session, in January
		60	70	1.2	70	12:10	13:10	COGENT ROADMAP	COGENT Sustainability Plan & Roadmap,	Erlene Manohar to moderate (supported by VJ & IK)	Moderated discussion to brainstorm ideas and schedule- including workplan and budget for COGENT Strategy implementation, linked to ITAGs circulate draft Roadmap and solicit SC comments before meeting...
		5	75	1.3	75	13:10	13:15	meetings/ interactions	Involvements in past and upcoming relevant meetings, including COGENT's 30th Anniversary in 2022	all	to promote COGENT visibility
		10	85	1.4	85	13:15	13:25	AOB	other issues neeeding attention	all	open space
		25	110	2	110	13:25	13h50		Day 3 Action points for ITAG / communications recommendations and next steps	all	discussion to produce recommendations

Appendix 7: 22nd Steering Committee Report

CONTENTS

ACKNOWLEDGEMENTS

COGENT and ICC would acknowledge the kind hospitality of the Malaysian Government, the management of the Impiana Hotel, Kuala Lumpur, the contributions from the 35 participants (including those online), especially those presenting or leading the ITAG strategic planning discussions

EXECUTIVE SUMMARY

The International Coconut Genetic Resources Network (COGENT) is a programme within the International Coconut Community (ICC), with the mandate for coordinating the conservation of global coconut genetic resources for their eventual use. It's Steering Committee (SC) provides policy and technical oversight, and meets biennially back-to-back with the ICC COCOTECH meeting to discuss COGENT's status and concerns. This 2022 Steering Committee was held on 12th November 2022, in Kuala Lumpur, Malaysia, after COCOTECH 2022. Amongst the 36 participants from 15 countries, six SC representatives, 13 official observers and nine genebanks were present (Côte d'Ivoire, Fiji, India, Indonesia, Jamaica, Malaysia, Mexico, Philippines, and PNG). Exchanges focused on: i) further strengthening COGENT's International Thematic Groups (ITAGs) to improve support for coconut germplasm conservation, exchange and use; ii) endorsing the SC 2021 recommendations; iii) consolidating COGENTs Strategic Conservation Road Map (StratCORM), and iv) reporting on project outputs of the ACIAR-funded COGENT revitalization project.

The Executive Director of ICC, COGENT coordinator (CC), PCA Administrator, COGENT SC acting Chair, and representatives from ACIAR and CIRAD provided encouraging opening remarks. The CC presented the outcomes of the ITAGs' Strategic Planning, and COGENT's status and accomplishments.

ACIAR grant work has achieved i) an orderly transfer of the COGENT Secretariat from Bioversity to ICC; ii) Established technical support for implementing COGENT's Global Strategy; iii) conducted rapid appraisals of the 5 ICGs, and iv) provided some initial support for their conservation activities, as well as launching considerations for income-generating components and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term. Major outputs were generated from the appraisals and series of consultative meetings, symposium and conferences. The ICG appraisals corroborated or identified major challenges including issues with land tenure, safe exchange, data management, scant resources, infrastructural deficiencies, staff shortages and other management issues. The appraisals examined the causes and effects of these challenges, and proposed solutions.

Prior to the SC meeting ITAG members prepared virtually, then face-to-face during COCOTECH to agree on key priorities and proposals, as summarized and presented during the SC meeting. Fully functional ITAGs will help ensure more effective conservation and use of coconut genetic resources. ITAGs' agreed priorities were presented as follows:

ITAG 1: i) Strengthen commitments to the ITPGRFA; ii) strengthen ICG sustainability by valorising CGR conservation through use; iii) lobby the CropTrust to help meet ICGs' needs; iv) convene meetings with high-level policymakers and donors; v) establish a common, user-friendly germplasm data management system; and vi) establish standard operating procedure across ICGs; and vii) duplicate unique and priority accessions.

After the SC meeting CIRAD presented on status and next steps in developing a standard Coconut Germplasm Data Management System in ICGs/NCGs to harmonize coconut conservation and breeding.

ITAG 2: i) Identify and prioritize genotypes in ICGs/NCGs with special traits for breeding and mass propagation; ii) collaborate in coconut genomic mapping; iii) develop and apply high-throughput molecular markers to document germplasm collections; iv) conduct molecular breeding research studies that explore biotic and abiotic resilience; v) conduct of collaborative research with ITAG1 and ITAG4; vi) facilitate germplasm exchange and distribution for hybridization programs.

ITAG 3: i) finalize a standard Biosecurity Protocol aligned to relevant national/regional biosecurity policies; ii) collaborate with ITAG 4 on clean TC planting material macropropagation and on mapping host-pathogen interactions for diagnostics using CTC technology; iii) develop and use digitized pest and disease epidemiological forecasting models as part of a standard pest and disease monitoring and control system (especially for genebanks); iv) organize an R&D network for a germplasm conservation and exchange IPM program to address major pest and disease problems aligned with ICC's IPM network; and v) develop regional control strategies for key pests and diseases (especially phytoplasmas and CRB)

ITAG 4: i) Standardize / optimize agreed cross-country CTC and cryopreservation protocols (with final proofs); ii) share CTC protocol technologies and use for mass propagation and germplasm exchange; iii) build (junior) researchers' capacity and monitor to assess how learning is applied; iv) establish / upgrade ICGs' CTC and cryopreservation facilities; iv) commercialize proven CTC protocols with private sector engagement as end user, for benefit of small and large producers. ICC and COGENT to organize stakeholders and enhance collaboration; v) Mobilize funding support for the Comprehensive Coconut Tissue Culture R & D Program; and vi) support ITAGs 1,2, and 3 for safe and effective germplasm conservation, exchange, mass propagation and breeding.

Cross-cutting ITAGs: i) facilitate recruiting local expertise to implement projects; ii) Identify key persons to contribute to proposal development; iii) integrate mid-career/ junior researchers TOR of membership and leadership should be reviewed; iv) Prepare proposal for funding and showcase R & D outputs linking to national replanting and planting programs of major coconut growing countries.

Road Map: The CC presented COGENT's strategic roadmap, highlighting the ITAGs' role in implementing COGENT's strategy, and outlining each ITAG's thematic agenda, outputs and outcomes drafted in the week's meetings.

A discussion moderated between SC members and panel of critics highlighted ITAG-linked several issues including: conservation capacity building; pest studies; germplasm collection, conservation (ex- and in-situ), characterization and utilization (breeding and commercially); smallholders as beneficiaries; COGENT and ICC membership; a stronger, time-bound strategic alignment of COGENT with ICC and its collaborators such as CIRAD and ACIAR, as well as the private sector; reviewing ICG host-country policy and other support, and biosecurity. In situ conservation featured frequently in the discussion.

ITAG leaders then each presented summaries of their strategic reflections for more effective and sustainable germplasm management and exchange. The logframe was organized in the four areas of : i) industry-responsive technology development; ii) ITAG R&D programme sustainability; iii) inter-ITAG synergy enhancement; and iv) the ITAG's sustainability investment plan. For each area, the groups listed their priority areas, strategies to address these priorities, the outcomes of implementing the strategies, what activities would be needed and what monitoring indicators. After each presentation there was a panel discussion as described in the report.

ITAG 1 touched on inter-ITAG collaboration; capacity building; ICGs / NCGs support; ICG business plans, and intellectual property rights. The discussion also featured ITPGRFA Article-15 agreement renewals, establishing new (multi-country) ICGs; accessions' availability and duplication; biosecurity; germplasm characterization guidelines and data management process; broadening ITAG1's approach; evaluating the impact of germplasm exchange, and ensuring genebank standard operating procedures (SOPs)

ITAG 2 highlighted the lack of coordinated breeding programmes, where COGENT member countries are conducting their own programs for yield and quality. A study on safe movement of coconut pollen is needed. Inter-ITAG collaboration should focus on : i) using coconut pollen for varietal development (pollen collection to follows STANTECH); ii) varietal development information sharing; iii) germplasm characterization for molecular-marker-assisted breeding; iv) Pangenomic studies with ITAG 1 between suggested participating countries; v) applying ("OMICS") tools for conservation and use of coconut genetic resources; and vi) establishing 'strategic alliances' with already existing genomic research team and set-ups

The discussion highlighted a need for i) a comprehensive understanding of genetic diversity available by linking with ITAGs 1,3,4 and including new coconut breeders to be members of ITAG2; ii) facilitating pollen exchange; iii) international breeding programmes; iv) farmer training programmes; and iv) accessing new populations for marker-assisted selection studies

ITAG 3 referred to i) importance for ITAGs role in conserving ICG accessions, especially regarding germplasm exchange biosecurity protocols to prevent spread of key problems such as lethal yellowing phytoplasmas; ii) remote/ satellite imaging tools for disease mapping for monitoring; young researchers' field training for new technologies; and iv) public-private funding partnerships.

There was extensive discussion on lethal yellowing disease (LYD). Identifying one high-capacity genebank to donate germplasm and one to receive the germplasm could test LYD biosecurity – a timeline/ proposal should be developed. Disease/pest resistance should be documented and integrated into improvement programmes, including using genomic analyses. Safe routes for germplasm movement need certifying (e.g. embryo exchange)

ITAG 4 The proposed research programme for TC and cryopreservation has already been well-articulated. Somatic embryogenesis TC technology can only be commercialized after further field evaluation and acclimatization studies have been conducted. The axillary shoot TC protocol has been successfully replicated in India and Sri Lanka and patented to protect free use for smallholders and researchers. The recent CTC and cryopreservation protocols training is yet to be evaluated. Some countries are asking ICC which technology is the best and most cost-effective, and for information on their comparative advantages. Those countries with laboratories need to transfer the technology considering IPR. ITAG 4 encourages collaboration (incl. with policymakers') in germplasm transfer/ drafting guidelines for CTC- mass propagation.

Cross-Cutting ITAG Issues: COGENT must improve communications to promote the ITAGs and their membership, with ITAGs meetings held every 3 or 6 months months. A key challenge in organizing ITAGs is to connect with focal points in some countries and hitches due to limited resources. A cross-cutting socioeconomics ITAG (already proposed by R Bourdeix) could help with developing ICG business plans

Steering Committee Meeting: After opening comments from acting Chair Alan Aku, SC role and structure, and 2021 recommendations (see annex 1) were presented. SC agreed that nominations for new ITAGs Team Leaders, SC Chair & Vice Chair will be administered virtually by COGENT coordination, in the coming weeks. Nomination forms will be circulated so people not attending this meeting can nominate and vote. Normally the SC invites the five COGENT regions to present their status and activities updates, however COGENT has already captured this in its recent international coconut genebank (ICG) rapid appraisals.

COGENT membership needs harmonizing, with clear terms of reference and policy guidelines, linked to ICC policies. ICC member-countries should automatically be part of COGENT. The list of COGENT national focal points (NFPs) needs updating with the corresponding enlisted government support, and should include nominating younger representatives. This should feature NFPs at appropriate policy-level as appointed by the host countries. Relevant research institutes from ICC member countries could be nominated for non-fee-paying associate COGENT membership. private-sector organizations or institutes from non-ICC member-countries could be levied a member fee. Engaging regional organizations as associate ICC members (e.g., Coconut Coalition of America or Intracen) may assist with resource mobilization. One CGIAR should be invited for ICC representation. Where non-ICC members subscribe to ICC free COGENT membership would be a bonus. ICC should re articulate the benefits of joining COGENT as part of ICC membership. In reviewing its membership policy, COGENT needs to consider who are its customers, and how COGENT can meet these needs.

Sustainable funding could be generated by industry levies; funds from the Crop Trust (e.g.as for coffee), or payments for ecosystem services / green climate funds (e.g. for carbon sequestration). ICG income generation should be a feature of sustainability plans. The private sector should feature in linkages with COGENT and the ICGs. ICC cost-recovery activities could be considered as for non-profit UN type organizations for climate change mitigation.

COGENT Website: the new COGENT website was presented

Other cross-cutting strategic Issues: COGENT must be aligned within ICC according to its road map. A balanced experts' roster should be updated from previous COGENT/ICC versions. Sustainability plans should include training in monitoring, germplasm exchange and biosecurity. There needs to be business mapping and wider involvement of coconut value-chain stakeholders, especially with industry and host countries. A fast-tracking mechanism is needed for certain priority protocols and proposals (e.g. biosecurity protocols and technology sharing). ICC needs to formally contact the appropriate high-level policymakers to ensure government involvement and action an international audit of breeding programmes is needed. More user-friendly germplasm catalogues should be developed for example like French Polynesia.

Erlene Manohar presented the draft high-level **recommendations** for 2022 as summarized below, and listed in greater detail in annex 6. linked to the 2021 recommendations drafted for 2021:

1. Align COGENT's strategy with that of ICC strategy efficiently oriented towards consumers & processors. To be fully coherent, the COGENT strategy should be complementary to that of ICC.
2. Institutionalize COGENTs collaboration with private sector, research agencies and coconut farming smallholders harmonized within the policies of ICC.
3. Upgrade and align COGENT membership with ICC policy-making level for more agency.
4. Complete and implement ITAGs' process of crafting the 5-year work program and investment plan to generate sustainable funding for ITAGs through the Crafting of the Road Map
5. Conduct consultative meetings with decision makers of genebank host countries to address causes of non-compliance to the ITPGRFA.

These recommendations are complemented by the above-mentioned ITAG priority areas (see also table 8).

COGENT's 30th Anniversary: A 30-year timeline was presented, and in addition to messages from Dr Alexia Prades, of CIRAD and Dr Gabrielle Persley, pre-recorded video messages were presented from former Coordinators Dr Stephan Weise and Dr Roland Bourdeix. Other former coordinators were invited to provide messages. Other files of photographs and videos dating back over at almost two decades were compiled but not presented.

1 MEETING BACKGROUND

Since 2018, the International Coconut Genetic Resources Network (COGENT) has been a programme within the International Coconut Community (ICC). COGENT has the mandate for coordinating the conservation of global coconut genetic resources for their eventual use. ACIAR and DFAT provided renewed support for revitalizing the network in 2020. This recent arrangement aims to ensure technical support for the implementation of COGENT's recently formulated Global Strategy for Conservation and Use of Coconut Genetic Resources (the Strategy) and with the following deliverables.

1. A functioning and sustainable **COGENT Strategic Programs**, supported by a financially capable ICC, with a designated full-time coordinator based at ICC, Indonesia, supported by the Secretariat of the Pacific Community (SPC), with an assisting coordinator based at SPC in Fiji, and support staff in Indonesia, with links to Asia, Africa and Latin America.
2. A doable **implementation workplan and budget** for the Global Strategy, highlighting links to the Pacific region. This deliverable will emanate from the four established **International Thematic Action Groups (ITAGs).** These group will be under responsibility of the COGENT Coordinator for strategy implementation with direct support of the ITAG leaders.
3. **Appraisal report of the coconut genetic resources** held in trust in the five multi-site international genebanks and in the national collections in 19 coconut growing countries, along with **recommendations for restoration and activation of the international multilateral system** and initial support for effective coconut germplasm exchange for utilization in the benefit of breeding programs. This strategy intends to improve coconut productivity and linked livelihoods, across the Asia-Pacific and beyond.
4. **Establishment of income-generating components** and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

COGENT has a Steering Committee (SC) composed of Chair and Vice-Chair plus voting regional representatives each from the five COGENT regions[13] an ICC representative, and observers representing international organizations. The SC provides policy and technical oversight. The SC traditionally meets biennially, back-to-back with the ICC COCOTECH meeting.

Having a fully functional COGENT will play a pivotal role in ensuring more effective conservation and use of coconut genetic resources. In turn this will contribute to building coconut stakeholders' capacity and resilience across the value-chain. Current work will ensure that the capacity to conserve coconut genetic diversity is strengthened and will contribute to ACIAR's aim of rejuvenating the coconut industry in the Pacific.

2 MEETING OBJECTIVES

The Steering Committee meeting is a regular consultative activity of the committee to discuss the status, developments, issues and concerns of the component groups of COGENT. The meeting is the venue for SC members and lead coordinators of the ITAGs and ICGs to present the challenges and progress of their respective activities in relation to the main purpose of COGENT as a research network for global coconut conservation of genetic resources.

[13] Latin America and the Caribbean; Africa and the Indian Ocean; South Asia and the Middle East;

This 2022 Steering Committee meeting focuses on the strategies and mechanisms of revitalizing the International Thematic Groups (ITAGs) to improve coconut germplasm conservation, exchange and use under the auspices of ICC. Further, this meeting aims to endorse the SC 2021 recommendations (see annex 1). This will push forward the crafting of COGENTs Strategic Conservation Road Map (StratCORM) towards a self-sustaining COGENT. Likewise, project outputs of the ACIAR funded project (extended to December 31, 2022) will be reported.

3 ITAGs STRATEGIC PLANNING PROCESS

COGENT conducted a three-day ITAGs consultative meeting from November 8-11 back-to-back with the COCOTECH conference. Each ITAG discussed its key priority areas in a 2-hour consultative meeting after COCOTECH sessions. The COGENT Coordinator provided guidance in the discussion based on the logical framework and the key result areas articulated during a sequence of weekly meetings during the month prior to COCOTECH.

In the SC meeting deliverables by COGENT as stipulated in the minutes of 2021 SC meeting were presented. After, the ITAGs reporting the compliance to the areas of concern recommended by the Steering Committee was fully discussed by the COGENT Coordinator. The recommendations areas of concerns and way forward plans were harmonized to enhance the set of strategies to address priority areas. Moreover, each ITAG reported the comprehensive functional framework of the key thematic areas. These frameworks are consistent to the Global Strategy Plan with desired activities, outcomes and indicators as the logical framework of the COGENT Road Map. These were presented to the SC members and invited representatives from ACIAR-DFAT, private sector and government policymaking officials to critique and enhance the ITAGs' work plan. The COGENT Coordinator provided each ITAG with a guide matrix in the development of the logical framework for each ITAG (Figure 1)

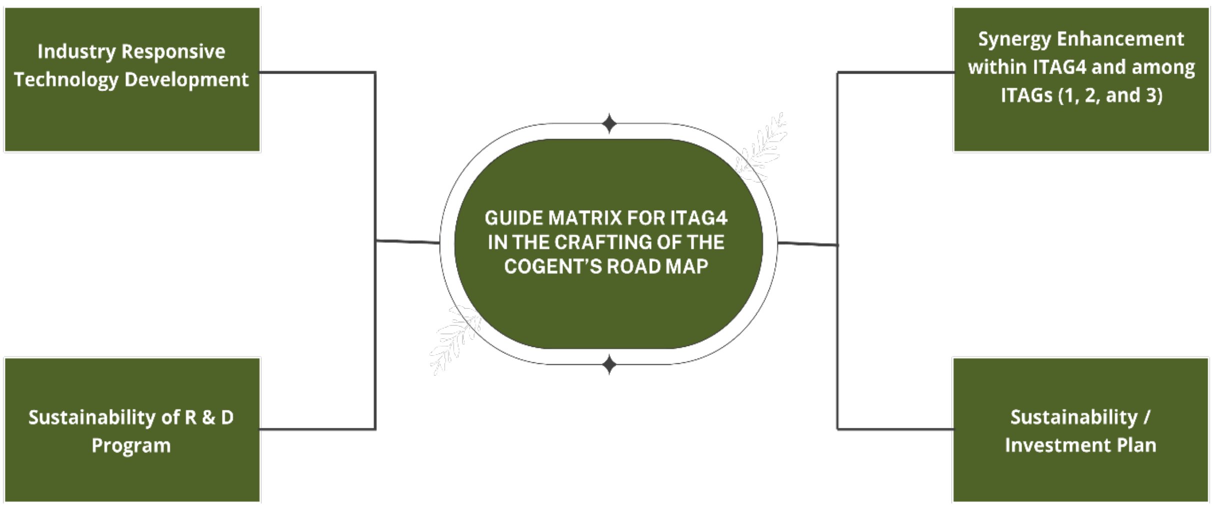


Figure 1. ITAGs Functional Framework

4 MEETING HIGHLIGHTS

4.1 Preliminaries

Preceding his welcome address, acting SC Chair Dr Alan Aku of KIK, PNG invited introductions of SC, ITAGs and plenary workshop panel members and other participants. Other ITAG members joined virtually via zoom. As meeting moderator, Vincent Johnson presented the meeting program (Annex 2) and welcomed the 36 participants from 15 countries (see Annex 3: 35 present, 1 online). Representatives from nine genebanks were present (Côte d'Ivoire, Fiji, India, Indonesia, Jamaica, Malaysia, Mexico, Philippines, and PNG)

Erlene Manohar, COGENT coordinator provided her opening remarks especially with regard to broadening the ITAG membership to include academia and donors.

Dr Jelfina Alouw, ICC Executive Director, provided some background on the value of coconut genetic resources. She highlighted the need for collaboration in addressing the challenges to coconut genetic resources conservation, especially for biosecurity compliance within the multilateral system (particularly with regards to responsibilities and roles). She finished her opening remarks by emphasizing the need for policies that support the conservation and use of coconut genetic resources (see annex 4 for fuller transcript)

Dr Julianne Biddle, External Engagement Director, ACIAR provided a welcome address of encouragement regarding COGENT's progress and the way forwards. This included delivering a short COGENT 30th anniversary speech from Dr Gabriel Persley (Co-founder COGENT), who outlined COGENT's key challenges in collection, conservation, characterization, and utilization, to make a wider range of genetic resources more readily available to growers, and replace senile palms worldwide (annex 4)

Dr Laurence Ollivier of CIRAD (Coconut research team leader) provided a brief welcome linked to CIRAD's coconut research road map and delivered a COGENT 30th anniversary speech from Dr Alexia Prades (annex 5)

Erlene Manohar then presented COGENT's status and a presentation of the new COGENT road map:

4.2 ITAG Strategic Planning Activity Objectives

Mrs. Erlene Manohar presented the OBJECTIVES of the ITAGs Strategic Planning as the prelude to crafting COGENT's Road Map. She acknowledged the efforts and commitment of the ITAG members who shared their ideas during the aforementioned meetings to articulate key areas of concerns and streamlining activities and critical issues. Despite the challenges of virtual interactions over different time zones, ITAGs succeeded in developing their matrix of key priorities. This activity represents a major step towards boosting the interest and commitment of COGENT-ITAG members. This aimed to promote the following:

1. **SHARING** ideas and insights to develop strategies to address challenges and develop a unified plan of activities aligned with the workshop objectives and expected outcomes.
2. **INTERACTING** within and between ITAGs to consider issues and concerns and arrive at sound agreement.
3. **STREAMLINING** critical issues, strategies and prioritization of plans and activities in given timelines and the needed indicative resources to generate the expected outputs and achieve the linked milestones
4. **PROVIDING** recommendations from stakeholders to formulate responsive strategies that will enhance the ITAGs' directions.

"Towards a Sustainable Management and Better Exchange of Coconut Germplasm"

Specifically, the objectives of this strategic planning and consultation meeting are intended to:

1. **unify** inclusive efforts and plans of ITAGs through sharing of information and insights for conservation management strategies and better exchange of germplasm
2. **review** the existing policies, guidelines and agreements related to conservation and germplasm exchange and formulate science-based strategies to address the challenges.
3. **decide** on the adoption of the standards germplasm data collection and updated data management system of the ICGs/NCGs.

4. **formulate** strategies that will strengthen synergy of ITAGs for larger membership and networks through inclusion of academic institutions and research funding agencies both local and international.
5. **deliberate** on collaborative priority project proposals of ITAGS for potential fund sourcing and identify the key persons/institutions to be engage in the projects**.**

In consideration of the set of goals and objectives, of the ITAGs Strategic Planning, it is expected to generate these following **OUTPUTS:**

1. **ITAGs agreed KEY AREAS** of concerns aligned to the Global Strategy Plan of Germplasm Conservation, Exchange and Use
2. **PRIORITY STRATEGIES** for the Ways Forward as a vital component of the Global Strategy
3. **ACTION PLANS** based on Strategic Objectives of the Global Strategy Plan with identified activities, targets, resources and timelines**.**
4. Sustainable and Synergistic **COGENT's ROADMAP FRAMEWORK** with well-defined Goals, Activities, Expected Outputs and Outcomes. (VMG)
5. Proposed Projects/Programs of each ITAG and **COLLABORATIVE PROJECTS** for fund sourcing.
6. **COMMITMENT of the ITAGs** for implementation and sustainability of the Global Strategy Plan

4.3 Presentation of the Status and Accomplishments of COGENT

The COGENT Coordinator emphasized COGENT's coordinating function in reactivating the ITAGs as the technical backbone of the network. Her presentation focused in COGENT's initiatives through the project supported by ACIAR-DFAT. She emphasized the significant outcomes in boosting the keen interests of the ITAGs composed of renown experts on their areas of specialization. She started by establishing the need to KNOW where COGENT stands, the CHALLENGES, the efforts and the OUTCOME of the initiatives for the last 3 years highlighting the importance of germplasm conservation in the context of industry development. The following reasons enumerated are:

1. Sustainability of coconut production and livelihoods critically depends on maintaining its broad genetic diversity through germplasm conservation
2. Germplasm conservation provides the industry with access to new and quality genetic material such as early-bearing and high-yielding varieties.
3. Diversity provides the genetic base to overcome critical biotic and abiotic threats attributed to climate change.
4. Addresses the lingering problem of supply-demand gap of the coconut industry.
5. Increases productivity to improve raw material supply congruent to increase income and provision of employment from the processing sector.

Having mentioned the considerations, she discussed the major objectives and goals of COGENT as the coconut conservation network (previously under Bioversity International). In general, COGENT aimed to improve coconut production on a sustainable basis and to increase incomes in developing countries by improving coconut cultivation and efficient utilization of its products through global germplasm conservation. Specifically, these can be achieved through a) development and implementation of **MECHANISM** to coordinate research activities of global significance. b) establishment of basis for **COLLABORATION** on the aspects of coconut research and development c) strengthening the **CAPACITY** of national, regional and global programs on conservation, exchange and utilization of coconut genetic resources.

After presenting the purpose of COGENT, she provided in the meeting what were generated from the project supported by ACIAR-DFAT hence, rationalized the maintaining COGENT in the 3-year project fund support ending December 2022. She also added that COGENT will solicit ACIAR's to continued partnering with COGENT's undertakings. In providing the substance of the project, she presented the project objectives and the Key Result Areas that were achieved as follow:

Objective 1: To achieve an orderly transfer of the COGENT Secretariat from Bioversity to ICC

Key Results:

1. Full-time COGENT Coordinator appointed on October 4, 2021
2. Completed the Participatory Rapid Appraisal (PRA) of the 5 ICGs.
3. Appraisal reports finalized with recommendations.
4. COGENT's regular monthly meetings with ICC, PGRFA, ACIAR-DFAT
5. Ongoing website uploading and 2 newsletters drafted
6. Weekly coordination meeting with ICC Secretariat.
7. Administrative and Financial Management by ICC
8. Full-time COGENT Coordinator appointed on October 4, 2021
9. Completed the Participatory Rapid Appraisal (PRA) of the 5 ICGs.
10. Appraisal reports finalized with recommendations.
11. COGENT's regular monthly meetings with ICC, PGRFA, ACIAR-DFAT
12. Ongoing website uploading and 2 newsletters drafted
13. Weekly coordination meeting with ICC Secretariat.
14. Administrative and Financial Management by ICC

Objective 2: To establish the foundation and provide technical support for the initial implementation of the Global Strategy for Conservation and Use of Coconut Genetic Resources.

Key Results:

1. Conducted Steering Committee meetings and planning for guided programs and activities as the policy making body of COGENT.
2. Reviewed COGENT membership and commitment renewal of member countries
3. Reactivated the technical support of ITAGs through consultation meetings, planning workshops to craft the COGENT road map.
4. Knowledge shared by experts and capacity building of junior researchers on coconut tissue culture and cryopreservation protocols for R & D sustainability.
5. Drafted the biosecurity protocol for safe germplasm movement.
6. Identified ITAGs key priority areas through inclusive strategic planning workshops.
15. Prepared action plans and ITAGs collaborative project proposals for presentation to donor agencies and private sector for fund sourcing

Objective 3: To conduct individual rapid appraisals of the 5-international coconut genebanks and provide initial support for the long-term conservation and evaluation of the conserved germplasm and integration of the collected data into the COGENT database.

Key Results:

1. Standard appraisal protocol was adopted using the Participatory Rapid Appraisal (PRA) of five ICGs and the Focus Group Discussions (FGDs) with the curators and research team of the host institutions of the five ICGs. to capture the real situation of the genebanks and the pressing the problems of managing the genebanks.

2. Harmonized and integrated the appraisal reports of five ICGs for management assessment and compliance to Article 15 of the Treaty. The findings and recommendation of experts that compose the appraisal team served as the basis in formulating strategies to mitigate the problems and gaps in the management of the genebanks. Priority areas of concerns were identified.

3. Conducted the 2nd International Coconut Tissue Culture and Cryopreservation Virtual Symposium, Round Table Discussion and Face-to-Face Training Workshop in India. These activities served as the platform of sharing knowledge and accelerating the development of tools in the mass propagation of coconut (including germplasm) and conservation of the genetic materials as one of the components of COGENT's Global Strategy. Existing Coconut Tissue Culture (CTC) research outputs were presented developed in various laboratories globally. Private sector representatives were engaged and made aware of the importance of the science-based tools for mass propagation and safe exchange of the genetic resources to be shared with the member countries.
4. Germplasm data management training/workshop proposal for capacity building of ICG data managers and curators for the new user-friendly database management program. Currently, the data management of the genebanks was under the CIRAD's accountability. However, the database program has to be upgraded for access of the data/information of the collections in the genebanks. This is a major activity that COGENT with the support of CIRAD has to be undertaken under the Crop Trust.

5. Crafted the final framework of the COGENT road map and drafted the Action Plans of ITAGs as workshop outputs. It has been the quest of COGENT to set the directions and milestones of the ITAGs on a unified and collaborative manner. The thematic areas of ITAGs and the interconnection towards achieving COGENTs vision are the key elements to be able to craft a road map with set of activities and timelines. After series of consultative and coordination meetings through the virtual platform, the COGENT Road Map framework was crafted.

Objective 4. To foster income-generating components and international research collaboration that will help sustain the COGENT program and the national and international collections in the longer term.

Key Results:

1. Developed the Cost and Return Analysis of the proposed income-generating activities for adoption of the ICGs to support genebank management costs. As a major recommendation after the appraisal of the ICGs is to provide income-generating models that will augment the needed funds for genebank management for self-sufficiency.
2. Prepared and submitted the SECURED proposal to access the Benefit-Sharing Fund of FAO September 2022 and endorsed by ICC
3. Drafted the ITAGs' proposals for submission to donor agencies and proposed engagement of private sector through Public-Private Partnership. On-going promotion of the ITAGs research outputs for potential partnership with private sector is in the pipeline.
4. Proposed business plan or investment portfolio of the ITAGs generated technologies for commercialization. The CTC mass propagation protocol is a potential technology being sought by private sector for business opportunities.
5. Promotion of the collected genetic resources for use of the industry and awareness campaign on through seminars and conferences and updating the COGENT website are planned.
6. Expanding the COGENT membership to include academic institutions, national and international research funding agencies as potential fund sources and partners in Research and Development. COGENT's guidelines of membership with some revisions were drafted for approval of the SC of ICC.

4.3.1 Project Workplans

She also discussed the outputs based on the component Work Plans (WPs) of the project addressing the set of objectives. These outputs generated were aligned to the goals of COGENT in achieving sustainable programs for better management of germplasm conservation and exchange. There were four major WPs with component activities such as:

Work Plan 1

1. COGENT programs/activities coordinated by a financially accountable ICC
2. Full-time coordinator hired by ICC in October 2021 to undertake COGENT coordination tasks
3. Provision of technical support from CIRAD
4. Assisting coordinator based at SPC in Fiji, and support staff in Indonesia, with links to Asia, Africa and Latin America.
5. Roles and responsibilities of COGENT's steering committee (SC) and for ICC within new COGENT Program were developed, or reviewed and amended.

Work Plan 2

1. An implementation workplan and budget for the Global Strategy, highlighting links to the Pacific region were established.
2. Activated the four (4) fully established International Thematic Action Groups **(ITAGs).**
3. Strategy implementation in direct cooperation with active engagement of the TAG leaders.

Work Plan 3

1. A status report on coconut genetic resources held in trust in the five multi-site international genebanks and in the national collections in 19 coconut growing countries.
2. Recommendations for restoring a functioning international multilateral system;
3. Initial support for effective sharing of coconut germplasm for the breeding programs; and
4. Strategy to improve coconut productivity and linked livelihoods, across the Asia Pacific and beyond.

Work Plan 4

1. The three-year project fostered income-generating components for sustainability of ICGs/NCGs
2. Established international research collaboration to help in the sustaining the COGENT programs
3. Sourcing of support to the national and international germplasm collections in the longer term

The COGENT Coordinator also emphasized that the expected deliverables of the project activities of the functional ITAGs of COGENT will play a pivotal role in ensuring the more effective conservation and use of coconut genetic resources in the context of responsiveness to the industry needs. These are expected to:

1. Contribute to building coconut stakeholders' capacity and resilience across the value-chain.
2. Offer an opportunity to more effective link of coconut genetic resources conservation and use;
3. Improve coconut-based livelihoods for coconut growing households and communities.
4. Ensure that the capacity to conserve genetic diversity of coconut is preserved and protected
5. Contribute to ACIAR's long-term program of work to rejuvenate the coconut industry in the Pacific

The COGENT Coordinator further discussed in her presentation that the expected deliverables out of the project activities of the functional ITAGs of COGENT played a pivotal role in ensuring the more effective conservation and use of coconut genetic resources. These are expected to:

1. Contribute to building coconut stakeholders' capacity and resilience across the value-chain.

2. Offer a golden opportunity to more effective link of coconut genetic resources conservation with their use.
3. Improve coconut-based livelihoods for coconut growing households and communities.
4. Ensure that the capacity to conserve genetic diversity of coconut is preserved and protected
5. Contribute to ACIAR's long-term program of work to rejuvenate the coconut industry in the Pacific.

Out of these deliverables and project activities, there were major outputs generated from the appraisal and series of consultative meetings, symposium and conferences.

Table 1. ICGs Major Identified Challenges, Causes, and Effects

ICGs	CHALLENGES	CAUSES	EFFECTS	PROPOSED SOLUTIONS	RESPONSIBLE PARTY/AGENCY
ICG-SEA	• Tenurial Status of the land for ICG-SEA • Germplasm Exchange • Data Management	• Urban Planning of LGU • No clear SOP for and monitoring of Germplasm Exchange implementation • No updated data management system	• No stable site for ICG and poor performance of the germplasm • No compliance from source countries of the designated germplasm • No continuity of data collection (latest is 2016)	• Legal Agreement with LGU of Manado and Ministry of Agriculture • Establish a muti-host country for ICG-SEA • Skills training for the curators on updated data management	• IPCRI, LGU, Ministry of Agri • ICC-COGENT, ITGRFA • ICC-COGENT and ICG-SEA
ICG-LAC	• Not fully managed • Lack of regular pest & disease monitoring system • Limited Germplasm Exchange	• Changes of curator • No regular surveillance • No addition or donated accessions except for the designated germplasm	• Transition adjustment • Leaf Atrophy Incidence and mite infestation • Sluggish conservation and germplasm exchange	• Designation of alternate curator • IPM adoption and regular surveillance of pests and diseases • Enhance coordination and promotion of the use of the elite collections	• EMBRAPA • EMBRAPA • ICC-COGENT & EMBRAPA
ICG-SAME	• Germplasm Exchange	• No strict monitoring and reporting system	• No germplasm exchange among member countries	• Develop a benefit sharing mechanism and policies	• ICC-COGENT
ICG-SP	• Germplasm Exchange • Unstable status of the ICG	• BCS Threat • Transfer of ICG to new site	• Restrictions for germplasm movement • Endangered the accessions	• Support to disease diagnostic studies and biosafety protocol • Transfer of title to KIK	• KIK and ICC-COGENT
ICG-AIO	• Germplasm Exchange • Data Management	• Maintenance thru concessioner • LYD threat	• Poor Genebank Maintenance • Restrictions for germplasm movement	• CNRA to change the maintenance arrangements • ICC-COGENT to provide updated data management program and capacity building	• CNRA • ICC-COGENT

Table 2. ITAGs Priority Thematic Areas, Strategies & Action Plans

ITAG 1	ITAG 2	ITAG 3	ITAG 4
Genebank (ICGs/NCGs) management and sustainability plans, SOP	Genotype selection with special traits for breeding program	Status of key pests and diseases globally Standard Biosecurity protocol development in coherence with the national/international biosecurity policies	Standardization and optimization of the CTC and Cryopreservation and germplasm exchange protocols including the field performance evaluation
Data collection and updating data management system in the ICGs/NCG using coconut ontology	Characterization of germplasm for molecular breeding using markers	Digitized forecasting models for pest outbreaks and disease distribution to safeguard genebanks. Development of Markers with reference to germplasm resistance to lethal diseases (ITAG 2 & 3)	Commercialization of the proven CTC protocols for mass propagation using plumule and inflorescence explants
Compliance to the treaty policies on germplasm exchange, distribution and benefit sharing and germplasm exchange targets	Germplasm Exchange for Breeding and varietal improvement including in-vitro cultures	Pathogen-host pathways for diagnostics and production of clean tissue cultured planting materials	Analysis of somaclonal variation in mass propagation protocols as preventive risk management measure
Development of proposals for income-generating activities	Pangenomic studies in collaboration with ITAG1	Project proposal for better and safe germplasm exchange with ITAG4	R & D Program and Investment Portfolio for business opportunities

4.3.2 Identified Priority Activities of ITAGs

ITAG 1: Ex-situ and In-situ Conservation

1. Revisit the Treaty regarding the commitment in coconut conservation (CropTrust).
2. Define the vision of sustainability by valorizing coconut genetic resources conservation through use
3. Support the international genebanks to lobby the CropTrust to help meet the need for establishing a solid base of the coconut multilateral system.
4. Hold a regional meeting with high-level policymakers through the MFA before the ACIAR end meeting. To present the status and the gaps based on the appraisal. To include the donors and take the opportunity during the COCOTECH meeting and finalize the project report and present to the with the stakeholders.
5. Prioritize ITAG to recruit implementors / experts on coconut because ITAGs are more of an advisory group but they need people on the ground to implement their projects.
6. Identify key persons to contribute to proposal development that will also require funding.
7. Involve mid-career/ junior researchers as team leaders, considering that most of the ITAG leaders are retiring, to prevent short-term leadership. The protocol and TOR of membership and leadership should be reviewed.

ITAG 2: Breeding and Genomics

- Identify and prioritize genotypes in the existing ICGs/NCGs with special traits for breeding programs and mass propagation
- Genomic Mapping of the selected collections of the ICGs/NCGs

- Use of high-throughput Molecular Markers for authenticity and correlation of germplasm collections.
- Conduct Molecular Breeding research studies for resiliency to biotic and abiotic factors
- Conduct of collaborative research with ITAG1 and ITAG4
- Facilitate Germplasm Exchange and distribution for hybridization programs on coconut growing countries.

ITAG 3: Safe Germplasm Movement, Entomology and Plant Germplasm Exchange Pathology

1. Develop and finalize a standard Biosecurity Protocol aligned to the national/Regional biosecurity policies of countries of the germplasm source and destination.
2. Conduct of collaborative research with ITAG4 on the mass production of clean planting materials through tissue culture and on mapping the pathogen-host pathways for diagnostics using the CTC technology
3. Develop and use digitized forecasting models for pest outbreaks and disease distribution mapping for diagnostics and prevention.
4. Organize an R and D network for a germplasm conservation and exchange IPM program that will coordinate and package strategies to address major pest and disease problems to be harmonized with the ICC-IPM Network.
5. Develop and adopt a standard Pest and Disease Monitoring System and IPM measures against the major pests and diseases in the ICGs/NCGs
6. Fund Sourcing and Capacity Building for technology development

ITAG 4: Coconut Tissue Culture and Cryopreservation

1. Standardize and optimize CTC and cryopreservation protocols developed in various laboratories. Refinements of the protocols and should be working across countries.

2. Encourage technology sharing and utilization of CTC protocols for mass propagation and germplasm exchange.

3. Build capacity of junior researchers for succession, upgrade CTC facilities of the five ICGs and follow-up monitoring to assess use of the trainees learned skills

4. Commercialize the proven CTC protocols with private sector engagement as end user. Need to meet the need of small-scale producers and big producers. ICC and COGENT to organize stakeholders and enhance collaboration. Develop final proofs of the working protocols for CTC technology promotion

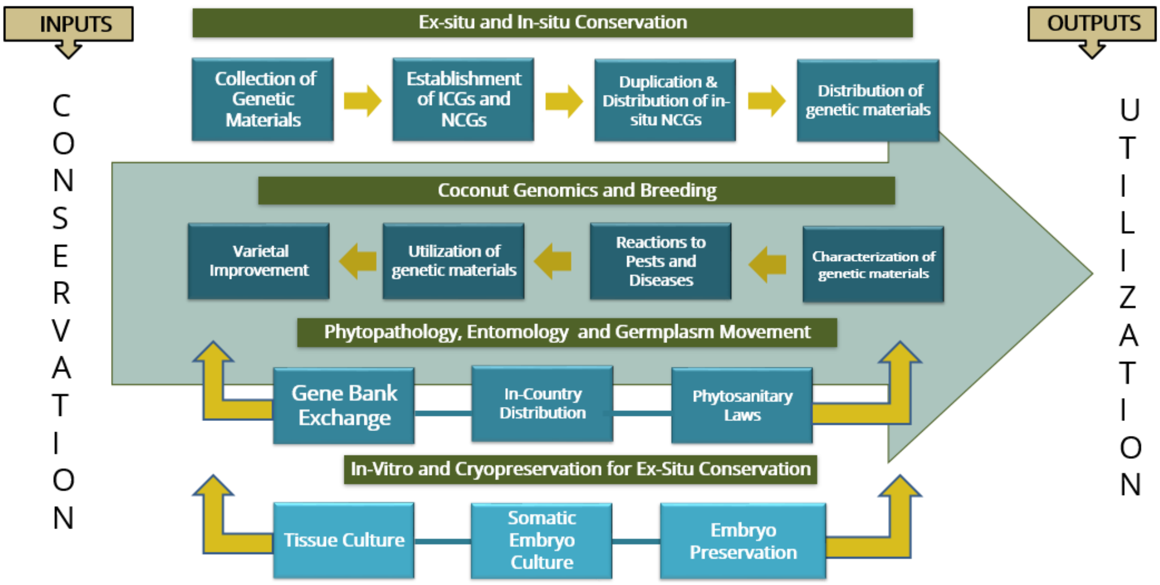
5. Mobilize funding support for priority thematic areas of the Comprehensive Coconut Tissue Culture R & D Program (e.g. CYLD diagnostics, CTC using the non-pathogen pathway tissues, resistance studies against abiotic and biotic stresses).

6. Prepare winning proposal for funding and showcase R & D outputs linking to national replanting and planting programs of major coconut growing countries.

7. Provide support to ITAGs 1,2, and 3 for better germplasm conservation, safe germplasm exchange, mass propagation and breeding

4.3.3 Crafting the COGENT's Strategy Road Map

As presented in the 2021 SC Ministerial meeting, the proposed COGENT's logical Road Map framework was based on the Global Strategy Plan. For this year 2022, the connectivity of the ITAGs thematic areas was deliberated by the ITAG members through the process of identifying the key areas of concerns in providing technical support to the challenges of germplasm conservation, exchange and its utilization responding to the needs of the industry. In the process, challenges and opportunities identified in conserving and sharing genetic resources served as the basis of formulating science-based measures for an effective germplasm conservation, safeguarding, exchange and utilization. Hence, the process of road map crafting involved the setting of objectives that can be achievable through the ITAGs thematic agenda. From the thematic agenda, outputs and outcomes were deliberated by the ITAG members through series of consultative meetings to come up with the indicative outcomes based on the Global Strategy Plan (Fig. 1). This road map is linked to the priority thematic areas identified by the ITAGs (Fig. 2) and the areas of collaboration among the ITAGs towards better conservation management and effective exchange and utilization of the genetic resources to accelerate the industry



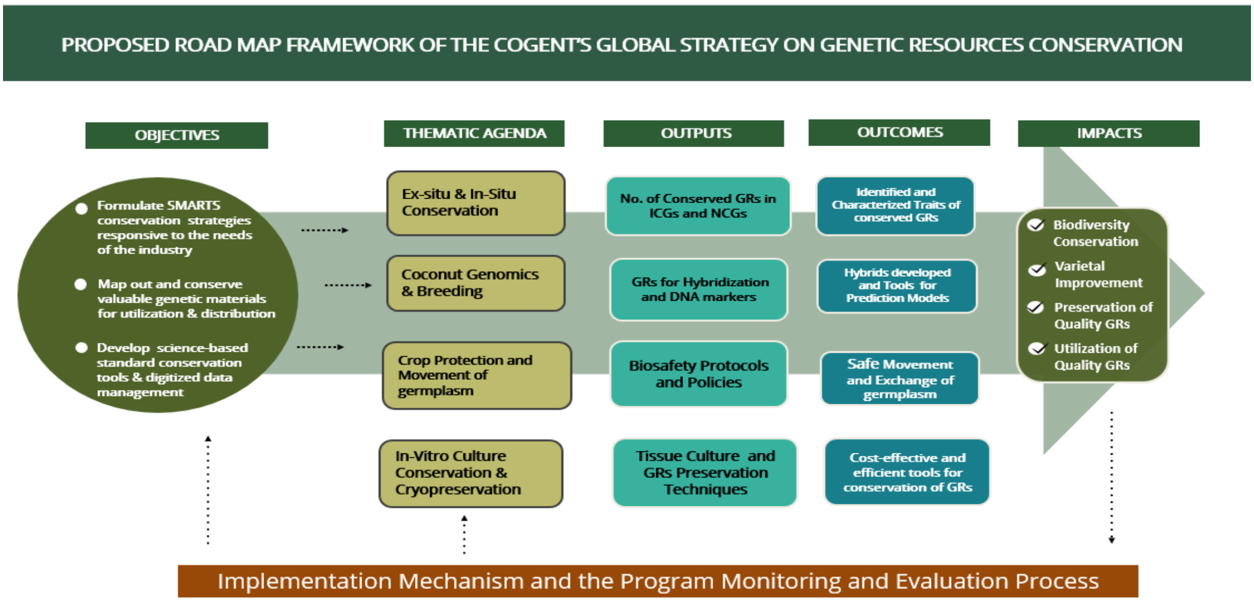
development. These basic elements of the COGENT's Road Map will set the DIRECTION and WAY FORWARD of COGENT for its full support to the ICC's mandate.

5 OPEN FORUM

After the presentation of the COGENT Coordinator, an open forum ensued with the SC members and the invited panel of critics. Julianne Biddle of ACIAR, that COGENT's activities are keen priority and she stressed that ACIAR and the University of Queensland are specifically interested on capacity building and on pest and diseases studies. She appreciated the efforts taken by ITAGs in their consultative meetings. She also mentioned that Bioversity started these programs in 1992 and appreciated the level that COGENT has reached. She further suggested that collection and conservation should be the top priority, molecular characterization and utilization.

She also asked, 'what does success look like for smallholders? and 'how to incentivize in situ conservation for farmers? It will be important to clarify the relationship of COGENT members especially with regard to support

Ms. Laurence Ollivier, emphasized the need for the new road map for coconut to align COGENT's road map. The challenge and the ambition is the use of genetic resources in breeding programs. She also stressed the need for an innovative system for developing new technologies in which CIRAD is very much involved regarding scientific research and as ITAG members. In response, COGENT Coordinator underscored that engagement of private sector as partner is much needed in achieving these objectives. Thus, there is a need to develop and implement collaborations that strengthen capacity in building the networks and for that sincere gratitude to ACIAR-DFAT in supporting initiatives of COGENT. As results, ITAGs already drafted the biosecurity protocol and the rapid appraisals of the five ICGs were completed, and this summary was the ICG appraisal report was presented as one of the COGENTs accomplishments under the ACIAR-DFAT funded project.



According to the COGENT Coordinator, currently this is the plan and in long term it will be extended to all stakeholders especially the marginalized coconut farmers. Mr Madrigal, the PCA Administrator and the Chairperson of the ICC-TWG asked clarifications on the relationship and membership system of COGENT and ICC. The COGENT Coordinator, clarified that since COGENT is a major program of ICC, it has to align its policies and direction to the concerns of ICC. However, inconsistencies in membership exist, since COGENT has 39 members countries and ICC has only 21 members as to date. Also, ICC members are coconut growing countries and paying membership fees, whereas COGENT's member countries are not paying any fee and others are not coconut growing countries. This is a major issue that has to be resolved and COGENT already drafted some revisions in the existing membership policy guidelines.

Regarding the challenges in the sustainability of the ICGs, Dr Lalith Perera, SC member and member of the ICG appraisal team stressed the issue of duplicating the ICGs being maintained by the host countries to ensure protection of the collections. He articulated three points: i) he emphasized COGENT's main goal is to support the conservation of coconut genetic resources; ii) to properly coordinating/ rationalizing COGENT-linked research faces many challenges especially with regard to ICGs the struggling to address these challenges requiring big investment, and iii) it will be important to understand COGENT role within ICC and ensure there is no overlap He also appreciated the works done by COGENT as an ICC program.

Dr Jelfina Alouw, Jelfina noted that the presented road map needs a timeline with milestones and that global activities need specific milestones within the ITAG this will be target accessions for ITAG 1 mapping major pests and diseases globally for ITAG 3 molecular markers genomics for ITAG 2 and tissue culture and cryopreservation for ITAG 4

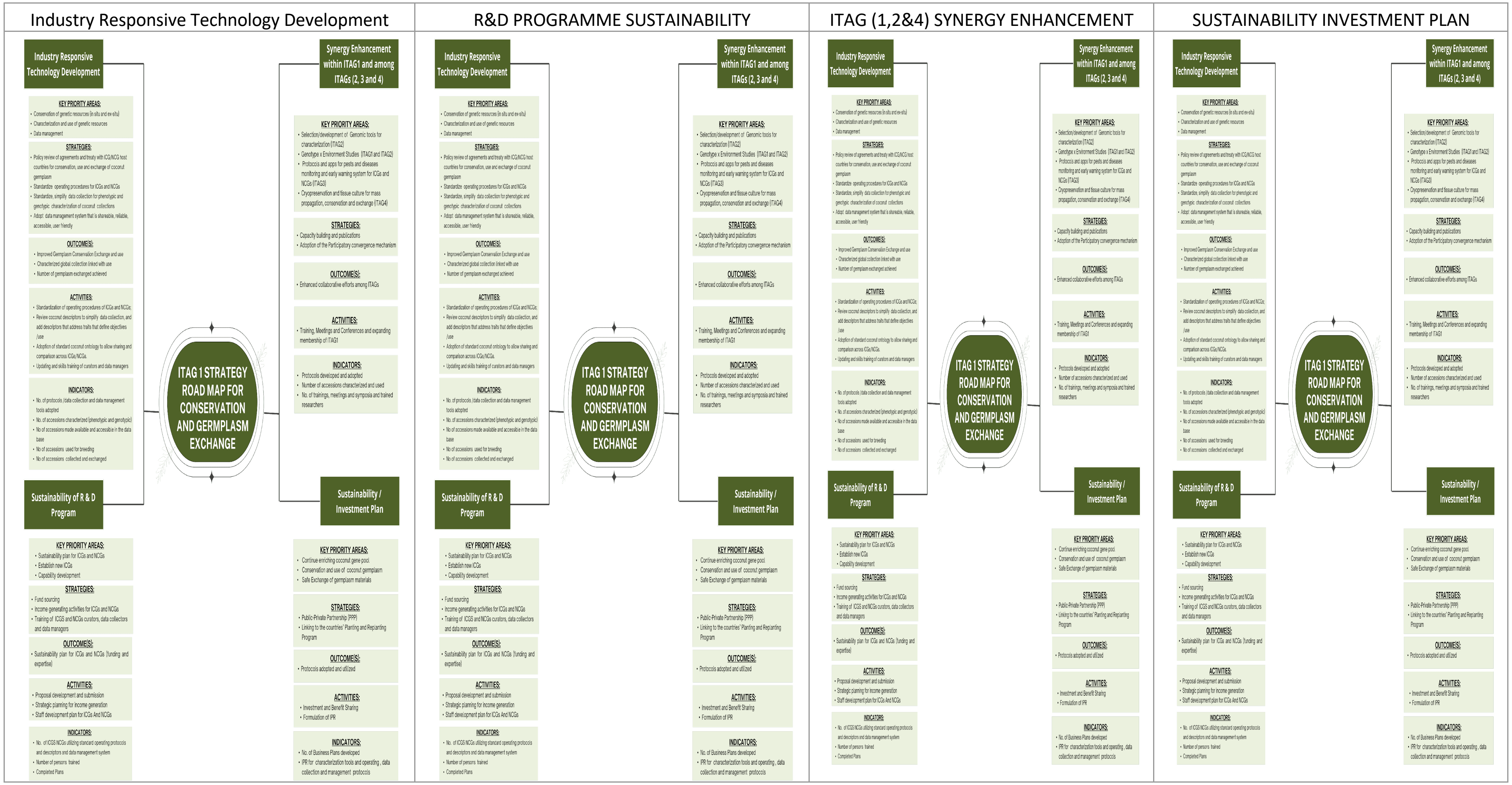
Dr Millicent Wallace of CARDI Jamaica asked a question regarding incentivising in situ conservation where policies matter.

Concerning germplasm management using the farmers' incentivized scheme as recommended in the presentation of the COGENT Coordinator. Dr Millicent Wallace supported this as a global strategy for in-situ conservation. Most of the gene banks are under treat so we have to find suitable biosecurity plans to protect the ICGs.

Further discussion of the road, TWG Chairperson Administrator Madrigal, reiterated that COGENT's vision as an organization must be focused on three major points such as collection, preservation, characterization and utilization in congruence with specific locations as demanded by the industry. He highlighted the Philippines' part in elite genetic material selection Dr Biddle added that for the industry it will be different from the farmers' needs.

The COGENT Coordinator reacted that it is a policy decision that can be formulated to enhance the farmers' participatory role in the conservation and utilization as major key player in the industry. As suggested by TWG Chairperson Madrigal, seeds can be taken by farmers, and they have to grow the seedlings and production coat to be subsidized by the government. Dr Aku of PNG, affordability will differ with agreements and provisions in accordance with the policies of the host government of the genebanks. Mr Ramon Rivera added that this can be proposed in the budget to include farmers plantation and the capacity building/education for coconut farmers. COGENT Coordinator that this was already done in the Poverty Reduction project during the stint of Dr Pons Batugal as coordinator. Likewise, Dr Carmel Pilotti of SPC and of ITAG 3, mentioned that in-situ conservation of the research institutions have to be taken into consideration, linked to general use and also use in public spaces.

6 ITAGs Strategic Reflections on Better Management and Exchange of Germplasm -ITAG1



6.1 For ITAG-1: Dr Andrea Garavito-Guyot presented the framework of the Sustainability Plan

The ITAG1 sustainability plan focused on collaborative efforts with other ITAGs and capacity building. Continuing support to the ICGs and NCGs through investment of host countries and from benefit-sharing funds. She also mentioned based on the consultative meetings with ITAG1 members regarding the formulation of Intellectual Property Rights mechanism and development of business plan for adoption of the income-generating activities. This includes considering how to manage intellectual property for characterization tools

Critiquing by the SC members and panelists

ED Alouw, inquired of the IPR characterization tools, and so far, not available. Dr Carmel asked the question whether this will for all countries and should encourage the existing ICG host countries for the renewal of the agreement under Article 15 of the treaty. In the case of the proposal for establishing new (multi-country) ICGs, Dr Hengky, breeder of Indonesia asked how can this be done? Mr Ramon Rivera threw back the question on what the status of Indonesia as an ICG is whether, they continue hosting the SEA-ICG since they don't have the foreign accessions in their genebank. Dr Aku added that in PNG only the accessions from Sri Lanka is available in the ICG-SP genebank. It seems that most ICGs mostly contained only local accessions

The need to share international accessions since, the old collections in PNG are gone. Moreover, he recommended for the Standard Operations Protocol for the ICGs/NCGs. Vincent Johnson added that it is important to ensure duplication of all the important accessions and the unique one. Dr Lalith stated that both ICG of SP and SEA must include the local collections from countries of the region. He also emphasized to prioritize the ICG issues.

Dr Konan of Côte d'Ivoire reiterated that still lots of accessions from everywhere, but lethal yellowing is the biggest problem in the exchange and collection for ICGs and NCGs. Hence support of donor countries have to be considered. Mr Christopher Biai of Malaysia was asked if Malaysia is willing to host an ICG and he said that Malaysia is really interested to host ICGs since in their NCG only local collections are planted. However, he has to consult top management to confirm whether the support will be provided for this partnership and official documents are needed for the concurrence of the policy making body of his country.

In the case of ICG-SEA in Indonesia, Ramon clarified that the exchange of accessions during that time was through the use of embryo technology. SEA countries are willing to share, but, that time no facilities were available in Indonesia, and this is included in the Term of Reference (TOR) of the germplasm exchange as per agreement. ED Alouw stressed that ICGs must comply with their agreements and mentioned that the declaration of intent for the three countries for the SEA-ICGs (Indonesia, Malaysia and Philippines) can be deferred. She suggested to attend first to the priority issues of the five ICGs based on the Appraisal before considering the multi-location genebanks of ICG-SEA. We need to verify the hygiene status of the collections. Host-country support details/ extent also need clarifying.

Laurence Olivier mentioned the MoU with Cirad including finalising the characterization guidelines and the data management process possibly involving the breeding management system (BMS)

Julianne Biddle wanted a broader approach

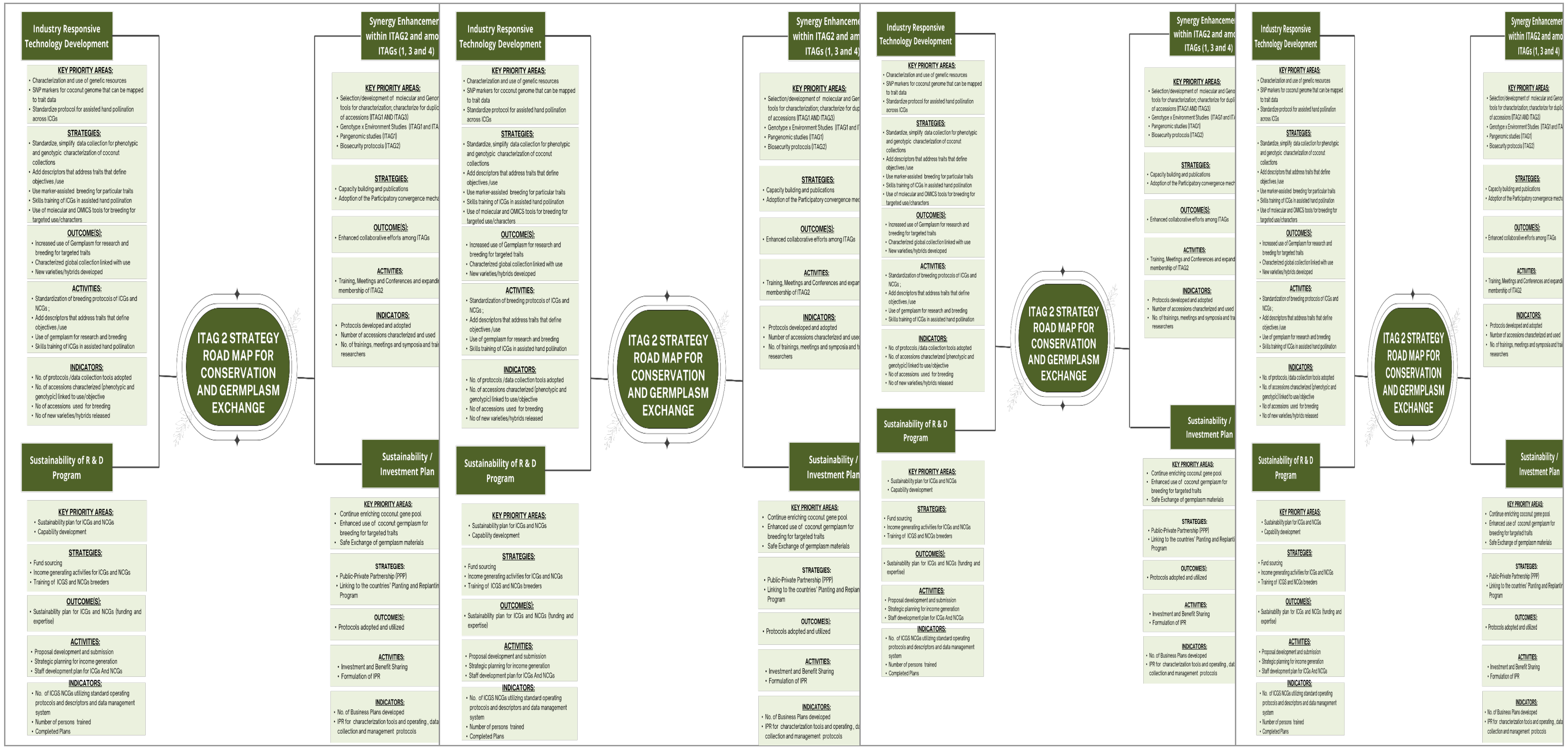
Jelfina suggested evaluating the impact of germplasm exchange

Standard operating procedures for the genebanks were mentioned

6.2 For ITAG 2: Mr Ramon Rivera presented the Sustainability Plan

Table 5. Guide matrix framework of ITAG 2

Industry Responsive Technology Development	R&D PROGRAMME SUSTAINABILITY	ITAG (1,2&4) SYNERGY ENHANCEMENT	SUSTAINABILITY INVESTMENT PLAN


ITAG 2 STRATEGY ROAD MAP FOR CONSERVATION AND GERMPLASM EXCHANGE
Industry Responsive Technology Development
KEY PRIORITY AREAS:
• Characterization and use of genetic resources
• SNP markers for coconut genome that can be mapped to trait data
• Standardize protocol for assisted hand pollination across ICGs
STRATEGIES:
• Standardize, simplify data collection for phenotypic and genotypic characterization of coconut collections
• Add descriptors that address traits that define objectives /use
• Use marker-assisted breeding for particular traits
• Skills training of ICGs in assisted hand pollination
• Use of molecular and OMICS tools for breeding for targeted use/characters
OUTCOME(S):
• Increased use of Germplasm for research and breeding for targeted traits
• Characterized global collection linked with use
• New varieties/hybrids developed
ACTIVITIES:
• Standardization of breeding protocols of ICGs and NCGs ;
• Add descriptors that address traits that define objectives /use
• Use of germplasm for research and breeding
• Skills training of ICGs in assisted hand pollination
INDICATORS:
• No. of protocols /data collection tools adopted
• No. of accessions characterized (phenotypic and genotypic) linked to use/objective
• No of accessions used for breeding
• No of new varieties/hybrids released
Sustainability of R & D Program
KEY PRIORITY AREAS:
• Sustainability plan for ICGs and NCGs
• Capability development
STRATEGIES:
• Fund sourcing
• Income generating activities for ICGs and NCGs
• Training of ICGS and NCGs breeders
OUTCOME(S):
• Sustainability plan for ICGs and NCGs (funding and expertise)
ACTIVITIES:
• Proposal development and submission
• Strategic planning for income generation
• Staff development plan for ICGs And NCGs
INDICATORS:
• No. of ICGS NCGs utilizing standard operating protocols and descriptors and data management system
• Number of persons trained
• Completed Plans
Synergy Enhancemen within ITAG2 and amo ITAGs (1, 3 and 4)
KEY PRIORITY AREAS:
• Selection/development of molecular and Genor tools for characterization; characterize for duplic of accessions (ITAG1 AND ITAG3)
• Genotype x Environment Studies (ITAG1 and ITA
• Pangenomic studies (ITAG1)
• Biosecurity protocols (ITAG2)
STRATEGIES:
• Capacity building and publications
• Adoption of the Participatory convergence mecha
OUTCOME(S):
• Enhanced collaborative efforts among ITAGs
ACTIVITIES:
• Training, Meetings and Conferences and expandi membership of ITAG2
INDICATORS:
• Protocols developed and adopted
• Number of accessions characterized and used
• No. of trainings, meetings and symposia and trai researchers
Sustainability / Investment Plan
KEY PRIORITY AREAS:
• Continue enriching coconut gene pool
• Enhanced use of coconut germplasm for breeding for targeted traits
• Safe Exchange of germplasm materials
STRATEGIES:
• Public-Private Partnership (PPP)
• Linking to the countries' Planting and Replantin Program
OUTCOME(S):
• Protocols adopted and utilized
ACTIVITIES:
• Investment and Benefit Sharing
• Formulation of IPR
INDICATORS:
• No. of Business Plans developed
• IPR for characterization tools and operating , data collection and management protocols

Mr Rivera in his presentation mentioned that majority of the COGENT member countries are conducting their own breeding program for yield and quality parameters (Malaysia (yield and oil quality), Thailand (yield, quality and volume of water), Indonesia (to include mass selection for dwarf populations), Philippines (commercial/ industrial traits; drought tolerance/ resistance) and Côte d'Ivoire (drought resistance/ tolerance) etc. He also highlighted the countries already exchanging germplasm using coconut pollen from outstanding dwarf and tall accessions such as Malaysia, Sri Lanka, Thailand, Philippines, Indonesia (?). He proposed that study on the safe movement of coconut pollen through phytosanitary assays/tests for major disease need to be done. Moreover, the following collaborative activities among ITAGs were recommended

a) Utilization of the coconut pollen for varietal development depending on the target traits (yield, quality, specific traits, biotic or abiotic resistance/ tolerance, etc.);
b) Pollen collection to follow the STANTECH Manual.
c) Sharing of information on the results of the varietal development project

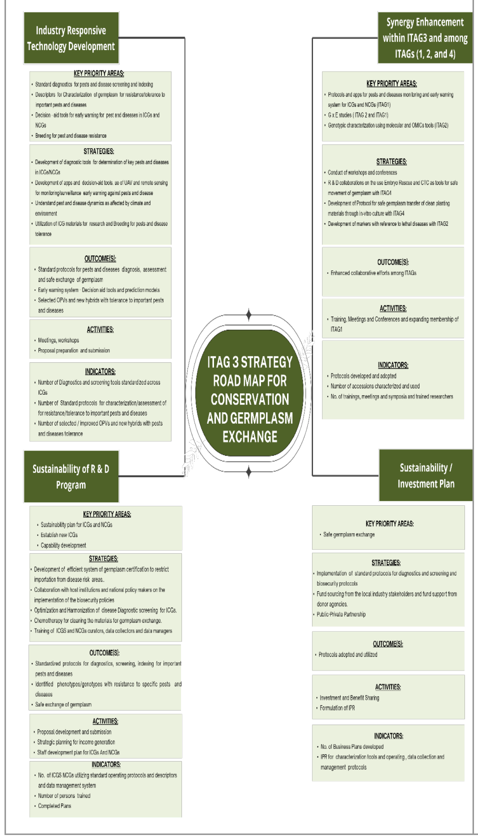
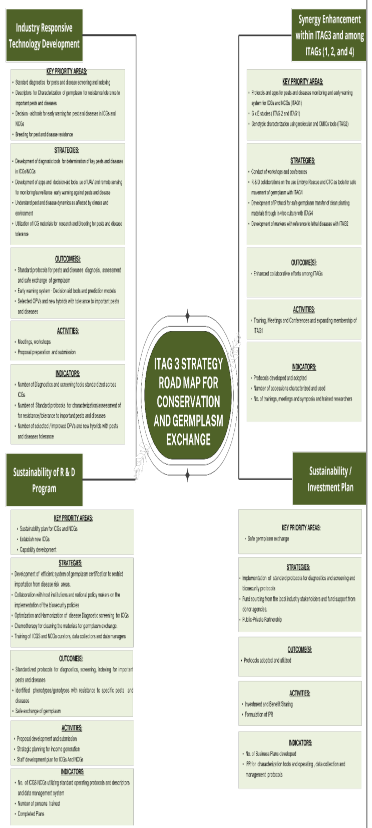
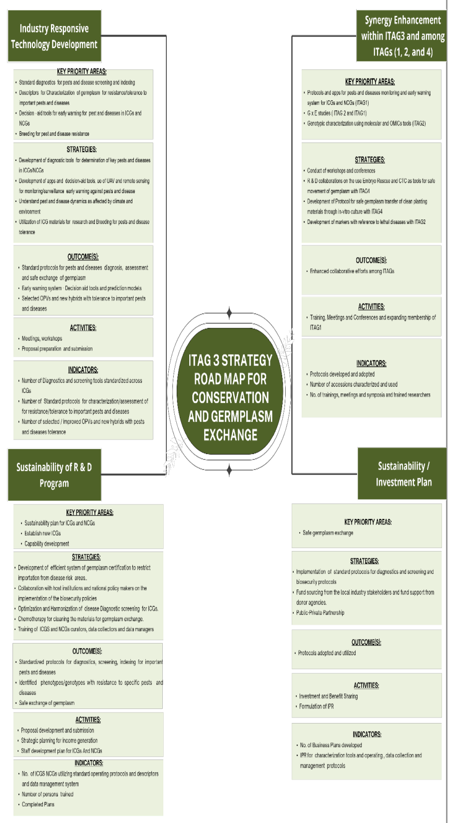
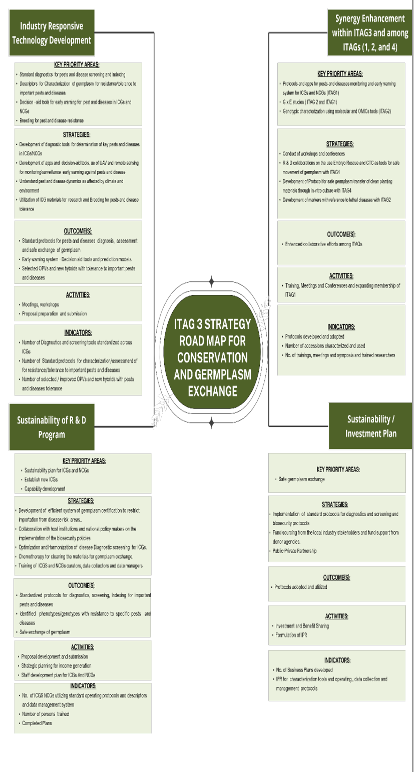
   of Thailand; 1) Thai Tall 2) Mu Si Som Dwarf, and 3) Mu Si Nam Tan Dwarf.
d) Characterization of germplasm for molecular breeding using markers
e) Pangenomic studies in collaboration with ITAG 1 with suggested participating countries (i.e Thailand, China, France (CIRAD), Philippines (?); and
f) Utilization of coconut genomics ("OMICS") as crucial tool for the conservation and use of coconut genetic resources.
g) establishing 'strategic alliances' with already existing genomic research team and set-ups

Dr Alan Aku, the SC chair implied the need for understanding the genetic materials by linking with ITAGs 1,3,4 and to include new coconut breeders to be members of ITAG2. Dr Hengky, the breeder from Indonesia inquired if exchange of pollen for commercial purpose can Indonesia have the possible exchange with Philippines (from PCA-Zamboanga Research Center). The PCA Administrator replied that presently, only allowed for pollen transfer is for research purpose. Whereas, Dr Lalith added that pollen exchange with Côte d'Ivoire and also with embryos of good variety, similar exchange program can be implemented by other countries but need to be careful with those with records of diseases. Dr Biddle inquired from the group if there is any benefit-sharing and Dr Lalith shared that it was only through personal contact of exchanging with their own materials on a give and take scheme. Other discussion points included:

- there needs to be a project for producing new varieties away from member countries'
- Dr Hengky from Indonesia mentioned producing new varieties…. they have Malaysian red dwarf but no outstanding talls, so he requested whether other COGENT members could provide pollen from the Philippines said this would be only for research purposes
- Administrator Madrigal mentioned the Philippines plan to establish a farmer training programme for the On-Farm Hybridization.
- marker assisted selection approaches need populations for further study

6.3 For ITAG3: Dr Wayne Myrie of Jamaica presented the Sustainability Framework

Table 6. Guide matrix framework of ITAG 3

Industry Responsive Technology Development	R&D PROGRAMME SUSTAINABILITY	ITAG (1,2&4) SYNERGY ENHANCEMENT	SUSTAINABILITY INVESTMENT PLAN
			

Dr Myrie highlighted that conservation of accessions is very important for the ICGs and the ITAGs activities are important component in this undertaking. One major aspect is to have standard protocol which is critical in the germplasm exchange especially due to the problem of lethal yellowing. He also mentioned that CIRAD is trying the remote/ satellite imaging for disease mapping to develop pests and disease monitoring applications. **Capacity building of young researchers by bringing them to the field to be trained on the new technologies. Also, he emphasized to adopt the public-private partnership for potential fund-sourcing scheme in the research and development program.**

The lethal yellowing resistant germplasm is critical, and TWG Chairperson suggested identifying the type of character for resistance to lethal yellowing for multiplication. Molecular markers for lethal yellowing disease resistance are so far unknown, but we need true LYD resistance to be developed. Wayne responded that there is a new plant breeder working on that. There was some discussion on lethal yellowing disease in terms of the transfer risk in embryos and how we can better control the disease. **Julianne Biddle suggests identifying one high-capacity genebank to donate germplasm and one to receive the germplasm to test the biosecurity issues around lethal yellowing disease and germplasm exchange - timeline should be developed**

Dr Rajesh commented that no variety has actually have shown tolerant to pests and diseases. But Dr Wallace of Jamaica mentioned that they have identified some in Jamaica. Dr Biddle as a rejoinder said that we need to start from somewhere and once available, these have to be shared and new genebanks to come up**. ED Alouw, added that ITAG3 to identify the key regional pests and diseases and focus the R & D to that such as LYD, Bogia Disease Syndrome and Rynchosporus problem of Indonesia.**

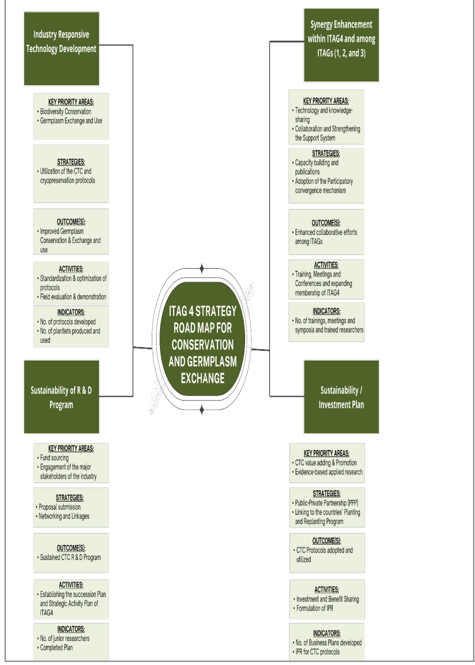
Dr Tek Tay of CSIRO, Australia inquired from ITAG members that in the crafting of the Biosecurity plan, whether genomic analyses of pathogens and pest variants are available. He asked about the RNA sequencing of LYD and genome of various organisms or nay genome sequencing done in any ICGs? what genomic resources are available for pest genome sequencing and characterizing viability what molecular markers … 2^{nd} or 3^{rd} generation sequencing or high throughput sequencing activities. The challenge is that extracting DNA takes both phytoplasma and coconut DNA which confuses things …. how many samples need to be taken? **Dr Andrea Garavito mentioned that CIRAD has done some sequencing, and there are transcriptomic essays in CICY, Mexico.**

According to Dr Lalith Perera, in the germplasm exchange using embryo, the pathogens can be destroyed. He cited CRI work has demonstrated safe exchange of embryos, these were collected, cultured, grown and field-planted and ten years after the 2012 exchange they are to established in the field

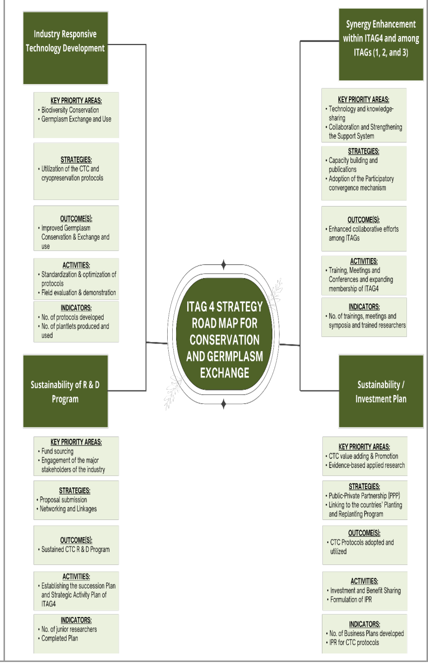
6.4 For ITAG 4: Dr Carlos Oropeza presented the Sustainability Plan and priority activities

Table 7. Guide matrix framework of ITAG 4

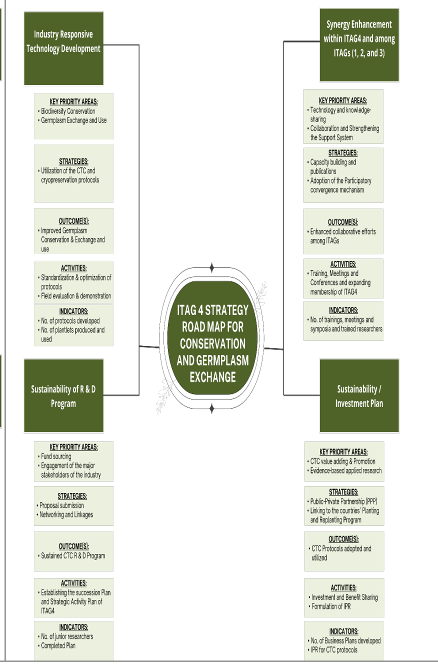
Industry Responsive Technology Development



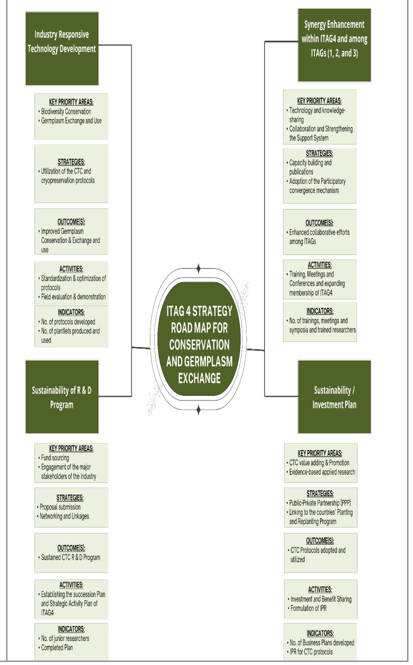
R&D PROGRAMME SUSTAINABILITY



ITAG (1,2&4) SYNERGY ENHANCEMENT



SUSTAINABILITY INVESTMENT PLAN



Mr Evan Lao of Chemrez, Philippines representing the private sector queried on whether the Coconut Tissue Culture (CTC) technology using the somatic embryogenesis can already be commercialized? **Dr Oropesa that there is need for field evaluation and further study on the acclimatization of the CTC. Regarding the CTC protocol of Dr Panis, India and Sri Lanka were successful in the repeatability of the technology and this was already patented and ready for use.**

Dr Rajesh asked the status of the activities of the trainees who underwent skills training on various protocols of CTC and Cryopreservation. **COGENT coordinator responded that there is a plan to assess the outcome of this training, however, the need to develop the appraisal system and to source out funds for the purpose.**

ED Alouw made some general statements with regards to the CTC protocols such as:

1. Several technologies developed: several countries asking ICC which technology is good for commercial way in line with cost effectiveness.
2. Information about the advantages of the technologies have to be provided
3. Countries having laboratories need to transfer the technology by executing agreements considering the IPR
4. Collaboration by producing the embryos and transfer to the requested countries.
5. Policy decisions by the policy makers need to be considered in drafting guidelines for mass propagation and germplasm exchange using the CTC technologies.

7 Issues on Membership

COGENT membership needs harmonizing, with clear terms of reference and policy guidelines, linked to ICC membership policies. ICC member-countries should automatically be part of COGENT. The list of COGENT national focal points (NFPs) needs updating with the corresponding enlisted government support, and should include nominating younger representatives. This should feature NFPs at appropriate policy-level as appointed by the host countries. Relevant research institutes from ICC member countries could be nominated for non-fee-paying associate COGENT membership. Private-sector organizations or institutes from non-ICC member-countries could be levied a member fee. Engaging regional organizations as associate ICC members (e.g. Coconut Coalition of America or Intracen) may assist with resource mobilization. One CGIAR should be invited for ICC representation. Where non-ICC members subscribe to ICC free COGENT membership would be a bonus. ICC should re articulate the benefits of joining COGENT as part of ICC membership. In reviewing its membership policy, COGENT needs to consider who are its customers, and how COGENT can meet these needs.

Sustainable funding could be generated by industry levies; funds from the Crop Trust (e.g.as for coffee), or payments for ecosystem services / green climate funds (e.g. for carbon sequestration). ICG income generation should be a feature of sustainability plans. The private sector should feature in linkages with COGENT and the ICGs. ICC cost-recovery activities could be considered as for non-profit UN type organizations for climate change mitigation.

8 Updated COGENT Website 2022 (under the ICC program)

For the information of the SC and ITAG members, the updated new COGENT website was presented by the COGENT Coordinator with the COGENT member countries map, CTC Virtual Symposium Proceedings, Round Table Discussion with Private Sector and the Face-to-Face Workshop/Training in India. Also, the summary of the Appraisal reports of the five ICGs were included in the website to be uploaded after approval of ED Alouw. Status, challenges, strategies and ways forward of the ITAGs as component of the Road Map was also described comprehensively.

9 Steering Committee Meeting

Chairman Alan Aku presided over and presented the agenda. He mentioned the priority issues to be resolved and to be approved for endorsement to the ICC-SC Ministerial Meeting on November 28, 2022 to be presented by the COGENT Coordinator.

Vincent Johnson reviewed the SC role and structure for the benefit of the new members of ITAGs. and then presented the COGENT SC 2021 recommendations (see annex 1)

The SC agreed that nominations for new ITAGs Team Leaders, SC Chair & Vice Chair will be administered virtually by COGENT coordination. Please be reminded that according to original agreed rules ITAG leaders should (at least ideally) be located within one of the COGENT member countries. There is a suggestion that France becomes a member country as currently its overseas territories such as French Polynesia cannot be direct members.

As a response to deliberations during 2021 to 2022, Erlene Manohar presented draft high-level recommendations for 2022 as summarized below, and listed in greater detail in annex 6. These are linked to the recommendations drafted for 2021, and are complemented by the summary of priority areas listed in the table 8 below

1. Align COGENT's strategy with that of ICC strategy efficiently oriented towards consumers & processors. To be fully coherent, the COGENT strategy should be complementary to that of ICC.
2. Institutionalize COGENTs collaboration with private sector, research agencies and coconut farming smallholders harmonized within the policies of ICC.
3. Upgrade and align COGENT membership with ICC policy-making level for more agency.
4. Complete and implement ITAGs' process of crafting the 5-year work program and investment plan to generate sustainable funding for ITAGs through the Crafting of the Road Map
5. Conduct consultative meetings with decision makers of genebank host countries to address causes of non-compliance to the ITPGRFA.

She also provided her insights on the current priority challenges that need to be addressed:

1. The current situation of the multi-site genebanks in Papua New Guinea, India, Indonesia, Côte d'Ivoire and Brazil has to be given attention.
2. Coconut conservation has to consider the poverty situation of the coconut farmers as a limitation, since farmers are reluctant to conserve indigenous varieties.
3. For in-situ conservation, investment on the adoption of technologies is not a priority to ordinary farmers.
4. The non-priority issue to the policy makers of the problems of the production sector and lack of interest to provide support on conservation program despite the major contribution of coconut to the economy of the country.
5. The fact that coconut farming is not a lucrative enterprise with low economic viability, hence, a factor to non-interest to conservation.
6. Limited policy support and inadequate resources for sustainability of the ICGs and NCGs.

She also mentioned that with such challenges as presented by the ICGs and ITAGs, key strategies were identified and priority activities have to done. These strategies can be incorporated in the StratCORM as initial efforts to come up with valid and problem-focused approaches. In the road map addressing the existing challenges is top most priority prior to new schemes. Hence, there were key strategies she presented based on the previous appraisal of the challenges presented by curators of iCGs and project leaders of ITAGs. These key strategies addressing the major challenges are relevant in the development of the road map to be able to determine the significance of these initiatives. It is worth appraising the has been activities and outcomes to be able map out the must be and the must not. Through this process, effective setting of directions shall be based on the benchmark data and clarified issues during consultations with the concerned groups/teams responsible in these major activities of conservation. Well-defined concerns are vital in this proposed crafting of the road ap which is will need support and cooperation among member countries, the ICGs and ITAGs.

PRIORITY AREAS	STATUS	GAPS	STRATEGY
1. Communication & Networking/Linkages	Initiated	Limited Physical Interaction	Updating Website and workshops
2. Revisiting the Global Germplasm Collection	Management Problems	Monitoring System	Regular Appraisal
3. Securing ex-situ conservation	Policy Problems	Host Country Commitment	Consultation with Policy Makers
4. Strengthening conservation beyond ex-situ genebanks	Cryopreservation tools developed	Issue on which laboratory to set	Setting criteria for setting up the facilities
5. Collecting and filling the gaps of ex-situ collections	Inadequate Germplasm Exchange (Gex)	Limited compliance of the donor countries	Enhance the Benefit-Sharing scheme of GEx
6. Strengthening safe germplasm distribution & exchange	CTC tools developed & available biosafety protocol	Optimization and Acclimatization	Full support for R and D
7. Promoting the use of genetic resources in addressing the needs of the industry stakeholders	Conduct of Symposia/Webinars	Funding Support	Partnership with Private Sector
8. Improving databases and sharing of technical information	Outdated DMS	No standard collection of data in ICGs/NCGs	Upgrading the DMS and training
9. Integrating genomics, marker-assisted breeding, DNA analysis	Experts and Proposals available	Limited Funds	Link to Germplasm selection/breeding

As presented, these are the key strategies that were recommended to the Steering Committee that needs their concurrence.

1. Revisit the status and outcome of these international gene banks and promote the impact to the coconut member countries in terms of germplasm utilization.
2. Mainstream the coconut farmers in the in-situ conservation process in addressing the erosion of coconut diversity by providing income-generating interventions focusing on the valuable uses of high-value germplasm.
3. On-farm expansion and distribution of identified high value genetic resources to serve as sources of quality planting materials and for use as parentals in the hybridization program.
4. Provision of incentivized farmer-participatory coconut planting of high value genetic resources thru national country programs.
5. Inter and intra cooperation among member countries on the conservation and germplasm exchange program focusing on high-value genetic resources with strategic distribution to balance the supply and market demand among member countries.
6. Propose R & D conservation projects on these thematic areas to address the challenges and provide science-based information and technical assistance to member countries of COGENT.
7. Develop a comprehensive proposal and practical germplasm conservation program from prospection, identification, formulation of techniques, distribution, promotion and utilization responsive to evolving market demand of different high-value coconut products.
8. Policy advocacy for conservation of genetic resources (i.e biosecurity, germplasm exchange, certification, phytosanitary concerns).

For her last slide she provided the template and vital components of the proposed StratCORM, that can be used also by each ITAG for their respective road map. In addition, she proposed an action plan for the development of inclusive and responsive road map in the conservation of the genetic resources and utilization as major component of industry development.

The members lauded the presentation of the proposed roadmap and pledged to actively support its development and objectives on the way to go as far as the conservation of genetic resources is envisioned to achieve an efficient and sustainable protocols for conservation.

Vincent Johnson, the Interim COGENT coordinator, and Dr Jelfina Alouw, the ED ICC would like to congratulate all the presenters and participants for a fertile and successful set of exchanges, that will help guide our common way forwards.

Dr Lalith recommended that the COGENT Coordinator has to develop projects for external donors for running the cogent programming. **The TWG Chairperson suggested to include the research institutes to become COGENT member, from ICC member countries, no need to pay any membership fee including the partner organization. But other institutes from non-ICC member country and partner organization and institutes need to pay some fees. Private sector as partners has to pay membership fee.** It was also recommended to explore the engagement of the Coconut Coalitions of America for income generating activities. Dr Carmel also advised to convince the non-ICC members to be part of ICC and they need not pay COGENT membership as one of the perks of being an ICC member. ED Alouw also informed the SC and ITAG members of the COGENT Coordinator in ICC.

10 Updates on Coconut Germplasm Data Management System

by Dr Andrea Garavito, CIRAD

Dr Andrea Garavito Guyot delivered a presentation on next steps for developing the standardized coconut germplasm data-management system in ICGs/NCGs. Different coconut genebanks (ICGs and NCGs) manage their germplasm data differently. Coconut germplasm data management needs upgrading and harmonizing under a new, upgraded common system that will replace COGENT's coconut genetic resources database (CGRD). Coconut germplasm data should be collected and managed according to a standard protocol, so that coconut conservation and breeding processes are harmonized. This will achieve international consistency. As a first step, a Trait dictionary, part of a Coconut ontology (controlled vocabulary) was elaborated based on the traditional descriptors and implemented using the data from CGRD.

Preliminary next steps will include:

1. **Identify a project leader to advance the Data Management System (DMS) project**
2. **Identify data officers contact point for each genebank**
3. **Identify and remove bottlenecks (mitigate risks)**
4. **Estimate what resources will be needed to collect/manage germplasm data (personnel, technical capacity, time, funds, equipment) using standard protocols**
5. **Develop budget and workplan for steps below, explore available in-kind contributions**
6. **Define outputs and activities including those below**

Development steps will include:

7. **For comparison, invite selected genebank data officers to an initial pilot evaluation phase, using the Coconut Ontology – CO and all the database available options**
    - **Breeding management system (IBP)**
    - **Grin-Global (Global Trust)**
    - **Google**
8. **Agree on principles for an ideal germplasm database / management system**
9. **Obtain the quotation for each of the database available options, stating the specific terms of reference**
10. **Select the most suitable, user-friendly, affordable, universal and sustainable option**
11. **Deploy a workshop to introduce the chosen DMS to the others ICG and NCG's data officers and curators**

Complementary steps could include:

- Seek SC endorsement of new variables identified in Darwin project Guidelines
- Identify 15-20 MINIMUM DESCRIPTORS from the total of 148 trait variables currently in the CO, on a palm-by-palm basis

- Obtain the engagement of the collections to use the CO for interconnectivity, if they decide not to use the developed DMS

A potential timeline is given below

activity	2022		2023											
	Q4		Q1			Q2			Q3			Q4		
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Identify a project leader	■	■												
2. Identify data officers contact point for each genebank	■	■	■											
3. Identify and remove bottlenecks	■	■	■											
4. Estimate what resources will be needed to collect/manage germplasm data	■	■	■											
5. Develop budget and workplan	■	■	■	■	■									
6. Define outputs and activities	■	■	■	■	■									
7. Invite selected genebank data officers to an initial pilot evaluation phase			■	■	■	■								
8. Agree on principles for an ideal germplasm database / management system			■	■	■	■								
9. Obtain the quotation for each of the database available options					■	■								
10. Select the most suitable, user-friendly, affordable, universal and sustainable option					■	■	■							
11. Deploy a workshop to introduce the chosen DMS to the others ICG and NCG's data officers and curators								■	■	■	■	■		
•Seek SC endorsement of new variables identified in Darwin project Guidelines										■	■	■	■	
•Identify 15-20 MINIMUM DESCRIPTORS								■	■	■	■	■	■	■
•Obtain the engagement of the collections to use the CO											■	■	■	■

Figure 4

11 Video Presentation of the Celebration of COGENT's 30th Anniversary

In addition to messages from Dr Alexia Prades, of CIRAD and Dr Gabrielle Persley, pre-recorded video messages were presented from former Coordinators Dr Stephan Weise and Dr Roland Bourdeix. Other former coordinators were invited to provide messages.

Other files of photographs and videos dating back over at almost two decades were compiled but were not presented.

Meeting Adjourned 6:00PM

12 ANNEXES

ANNEX 1 SC 2021 Meeting draft recommendations

The COGENT SC recommends that:

6 MEMBERSHIP

6.1 COGENT adds an alternative member representative for each of the 5 ICGs as follows: i) LAC- Brazil, Dr Semíramis RAMOS; II) AIO- Côte d'Ivoire, Dr Tra Serges DOUBI or Dr Thierry THAKRA LEKADOU; iii) SAME, India, Dr Anitha KARUN; iv) SEA- Indonesia, Dr Stevie KAROUW; v) SP- PNG, Dr Carmel PILOTTI

6.2 COGENT adds Dr Matija OBREZA, as an OBSERVER member representing the CropTrust

7 PLANNING MEETINGS

7.1 ICC formalises monthly COGENT programme meetings – third Wednesday of month (7 to 8 am CET) to include VJ, JA, MK, PB, CP, plus occasional presence of other regional reps (as potential assisting coordinators. Draft repeating agenda: proposals, ICGs, ITAG status, progress of ACIAR workplan, events (trainings conf workshops etc), sustainability plan

8 COCONUT GENEBANKS

8.1 In consultation with FAO-ITPGRFA, COGENT assists in reviewing and renewing the Article 15- ICG hosting agreements for all 5 ICGs. ITPGRFA will develop first draft letters to amend existing agreements (ICG-AIO and ICG-SP) , or to develop new agreements (ICG-SAME, LAC and SEA). An agreed draft will be shared with each host government contact in preparation for signature, along with FAO and ICC

8.2 COGENT formalises an alternative representative for each ICGs (see recommendation 1) to be responsible for transferring interesting accessions into ICG (all accessions available in one request)

8.3 COGENT facilitates national coconut genebanks to develop international status (e.g. the Philippines, Malaysia, Sri Lanka, Jamaica)

8.4 COGENT finalises the ICG pre-appraisal visit questionnaire in preparation for the remaining four ICG appraisal visits, and agrees visit dates, within the constraints of the COVID-19 pandemic, and COGENT finalises the ICG-SP appraisal report

8.5 ICG Curators and COGENT develop an ICG and COGENT Sustainability Plan that allows them to sustain themselves.

8.6 In conjunction with host country governments, ICG curators and COGENT develop a Genebank Biosecurity Plan that links to national biosecurity plans (if existing), and if not COGENT will liaise with the host to develop such a plan. Part of the plan will include a section on quarantine and phytosanitary responsibility and measures when receiving or donating germplasm and involving national quarantine agencies and certification mechanisms (ICC-COGENT can provide support but not certification, plus recipient country risk analysis). Special attention will be paid to auditing for lethal yellowing-like phytoplasma infestation, linked to effective diagnosis.

9 INTERNATIONAL THEMATIC ACTION GROUPS (ITAGS)

9.1 Nominated ITAG leaders confirm their willingness to participate and review membership, including settling the issue of leaders coming from COGENT member countries

9.2 ITAG leaders convene and report on monthly virtual meetings (and ad hoc physical meetings when events allow) to update on any progress in their field

9.3 ITAG leaders begin formulating /developing their list of prioritised research idea/ projects linked to the Strategy, to include support for ICC's coordinating role. ITAG1 will focus on ICG-related conservation management matters; ITAG 2 consolidating genomics and breeding links; ITAG 3 considering Biosecurity planning and conducting a survey/ review of (proven) diagnostic tools; ITAG 4 compile links to all TC and cryo protocols, provide snapshot of validation status to begin preparing for TC symposium and India Workshop. These priority projects will form the basis of renewed resource mobilisation/ proposal development.

9.4 Together, ITAG leaders contribute to developing the COGENT Strategy implementation plan and budget.

10 GERMPLASM DATA MANAGEMENT

10.1 COGENT takes steps to improve germplasm data management, including:

10.2 reviewing data-sharing restrictions, agreements, including soliciting advice from relevant bodies like ITPGRFA, Cirad and Bioversity-CIAT Alliance

10.3 review current status of ICG and CGRD germplasm data, and decide what needs updating/ re-collecting

10.4 organising a timeframe and support for CGRD data migration

10.5 organising statistics and data-management capacity building for member countries-linked to COGENT germplasm data-management training. This will be a possible collaboration with the Alliance of Bioversity and CIAT, Cirad, the CropTrust and the Integrated Breeding Management Platform for the Breeding Management System (https://bmspro.io/) (back-to-back with Malaysia COCOTECH meeting or other)

10.6 developing a COGENT germplasm data management strategy

Annex 2: 22ND COGENT STEERING COMMITTEE / ITAGs MEETING PROGRAM

November 12, 2022, Hotel Impiana, 13, Jalan Pinang, Kuala Lumpur, 50450 Kuala Lumpur, Malaysia

07:30 -08:30	In-person & virtual Registration participants	Vincent Johnson/ Klaudio Hosang
08:30 - 09:00	Welcome Message Meeting Overview: Rationale, Objectives, Process & Introducing meeting Participants	Erlene Manohar, COGENT Coordinator
09:00 -09:10	Opening Remarks	Jelfina Alouw, ICC Exec. Director
09:10- 09:15	Message	Julianne Biddle, ACIAR
09:15-09:20	Message	Laurence Ollivier, CIRAD
09:20 - 09:40	COGENT status and Road Map presentation	Erlene Manohar
09:40 - 10:00	**Discussion on Road Map**	
10:00 - 10:15	**Coffee**	
10:15 - 12:00	Summarizing ITAGs' strategic reflections	20-25 Minutes per ITAG leader
12:00 - 13:00	**Lunch**	
13:00 -15:00	Panel Discussion on ITAG strategic reflections	Panelists : SC, TWG Chair, ACIAR, CIRAD, ED, Private sector, MARDI
15:15 - 15:45	• Adoption of 2022 SC meeting Agenda • Presenting and endorsing 2021 meeting Minutes (for information & actions taken) • Review of SC, COGENT & ITAG Membership Guidelines, • Nomination of ITAGs' Team Leaders • Nomination of SC Chair & Vice Chair • Handing over of the Chair	Vincent Johnson Supported by panel Alan Aku/ Lalith Perera

15:45- 16:15	Presentation for SC Endorsement for Approval of SC & endorsement to ICC-TWG	Erlene Manohar
16:45 – 17:00	**Coffee**	
16:15 -17:15	Presentation of Priority ITAGs Project Proposals/ Activities	ITAG Team Leaders
17:15- 17:30	Presentation and discussion on next steps for developing coconut germplasm data management system in ICGs/NCGs	Vincent Johnson Andrea Garavito-Guyot
17:30 - 17:45	Adoption of Draft Recommendations	Erlene Manohar
17:45 – 18:00	AOB & Meeting wrap up	
18:30- 19:30	**DINNER & ADJOURNMENT**	

ANNEX 3: MEETING PARTICPANTS

#	Observer	ICG/NCG/COGENT	alt COGENT	ITAG leader	Private	Salutation	First name	Last name	Institute	Country	time zone cluster	email	COCOTECH	VIRTUAL	ITAG	SC MEETING	Voting rights
1		1				Dr	Aku	Alan	KIK	PNG	2	aaku@kik.com.pg	1		1	1	1
2		1				Dr	Jelfina	Alouw	ICC	Indonesia	2	jelfina@coconutcommunity.org	1			1	1
3		1				Dr	Christopher	Biai	MARDI	Malaysia	2	christopherjb@doa.gov.my	1		1	1	
4	1					Dr	Julianne	Biddle	ACIAR	Australia	2	Julianne.Biddle@aciar.gov.au	1		1	1	
5	1			1		Dr	Roland	Bourdeix	Diversiflora/CIRAD	France	1	roland_bourdeix@yahoo.fr ;		1	1	1	
6	1			1		Dr	Andrea	Garavito-Guyot	CIRAD	France	1	andrea-maria.guyot@cirad.fr	1		1	1	
7	1					Mr	Vincent B	Johnson	ICC	France	1	v.johnson@cgiar.org	1		1	1	
8			1			Dr	Steivie	Karouw	IPCRI	Indonesia	2	steivie591972@gmail.com	1		1	1	1
9		1		1		Dr	Anitha	Karun	CPCRI	India	2	anitha.karun@icar.gov anithakarun2008@gmail.com	1		1	1	1
10			1			Dr	Jean Louis	Konan Konan	CNRA	Ivory Coast	1	konankonanjeanlouis@yahoo.fr; konankonanjeanlouis@gmail.com	1	1	1	1	1
11	1					Dr	Mridula	Kottekate	ICC	Indonesia	2	mridula@apccsec.org	1		1	1	
12	1					Mr	Benjamin	Madrigal	PCA	Philippines	2	?	1	1	1	1	
13	1					Ms	Erlene C	Manohar	ICC	Philippines	2	erlenemanohar2020@gmail.com	1		1	1	
14	1					Mr	Daniele	Manzella	ITPGRFA	Italy	1	Daniele.Manzella@fao.org	1		1		
15			1			Dr	Rajesh	MK	CPCRI	India	2	mkraju_cpcri@yahoo.com	1		1	1	
16				1		Dr	Wayne	Myrie	CIB	Jamaica	1	cocindbrd@cwjamaica.com waynemyrie@hotmail.com	1		1	1	1
17			1			Dr	Hengky	Novarianto	IPCRI	Indonesia	2	hengkynovarianto@yahoo.com	1		1	1	
	1					Dr	Laurence	Ollivier	CIRAD	France		laurence.ollivier@cirad.fr	1		1	1	
18		1		1		Dr	Carlos	Oropeza	CICY	Mexico	1	carlosmos@yahoo.com; coscicy@gmail.com	1		1	1	

#	Observer	ICG/NCG/COGENT	alt COGENT	ITAG leader	Private	Salutation	First name	Last name	Institute	Country	time zone cluster	email	COCOTECH	VIRTUAL	ITAG	SC MEETING	Voting rights
19	1					Dr	Bart	Panis	Bioversity-CIAT Alliance	Belgium	1	b.panis@cgiar.org; Bart.Panis@biw.kuleuven.be	1		1	1	
20		1				Dr	Lalith	Perera	CRI	Sri Lanka	2	kanthaperera@yahoo.com	1		1	1	
21	1					Dr	Fabien	Pilet	CIRAD	France	1	fabian.pilet@cirad.fr	1		1	1	
22		1		1		Dr	Carmel	Pilotti	SPC	SPC	2	carmelp@spc.int	1		1	1	
23		1				Dr	Ramon	Rivera	PCA	Philippines	2	rlrivera_pca@yahoo.com.ph	1		1	1	
24			1			Dr	Vijitha	Vidnanaarchi	CRI	Sri Lanka		vijitharma@yahoo.com	1		1	1	
25			1			Dr	Hegde	Vinayaka	CPCRI	India		vinayaka.hegde@icar.gov.in	1		1	1	
26			1			Dr	Millicent	Wallace	CARDI	Jamaica		milliewall04@yahoo.co.uk	1	1	1	1	
27			1			Dr	Ruben	Rico	?			ruberic58@gmail.com	1		1	1	
28			1			Dr	Sukati	Sakka	MARDI	Malaysia		sukati@doa.my	1		1	1	
29	1					Dr	Wee Tek	Tay	CSIRO	Australia		weetek.tay@csiro.au	1		1	1	
30	1					Dr	Murial	Okoma	?			muriel.okoma@gmail.com	1		1		
31			1			Dr	Chantelle	Campbell-McTaggart	CIB	Jamaica		chantelle.mctaggartcib@cwjamaica.com	1		1		
32					1	Mr	Evan	Lao	CHEMREZ	Philippines		evanlao@dnl.com.ph	1		1	1	
33					1	Mr	David	Lobo	Deejay Farms	India		davidlobo@deejayfarm.com	1		1		
34						Mr	Alit	Primarsh	ICC	Indonesia		alit@coconutcommunity.org	1			1	
35						Mr	Klaudio	Hosang	ICC	Indonesia		klaudio@coconutcommunity.org	1			1	
36																	
	13	8	10	6	2							0	35	4	31	30	6

ANNEX 4: OPENING REMARKS

Guidance and Commitment support of ICC to COGENT's Initiatives and Plans

Dr Jelfina Alouw, ICC Executive Director,

focused on the need for collaborative efforts of all the ITAGs members and leaders, the COGENT member countries and the diligence of the COGENT Coordinator in coming up with harmonized and unified direction of the ITAGs responsive to the needs of the industry. She also recognized the support of the partner organizations such as ACIAR-DFAT, FAO-ITGRFA, CIRAD, One CGIAR and Bioversity. In her message she provided inspiring insights on the following aspects of integrating expertise, resources and various networks towards conserving genetic resources and protecting coconut biodiversity. She also mentioned the need for quality planting materials in the planting and replanting programs of the member countries to replace the senile and damaged coconut trees. Further, she mentioned that in the era of industry complexity and volatility, challenges can be surpassed by integrating efforts and collaborations. Regarding issues on technical aspects, she discussed the availability of the macro and micronutrients in coconut, vulnerability and suitability of the varieties of coconut to natural calamity and what to plant in high terrain areas. Science-based strategies must look into extending the shelf-life of fresh coconut as an example. With reference to this, selection of germplasm for specific quality traits is dependent in improving germplasm conservation and exchange to create the impact of the germplasm utilization.

She also stresses the need to have good evaluation of the socioeconomic impacts to coconut farmers and their participation in the conservation and diversity protection. She also discussed the challenges confronting the management of genebanks which is of prime importance especially in protecting from pest and disease (e.g., Bogia Syndrome Disease). Collaboration among stakeholders of the industry, funding agencies and research institutes has to be established to support the Research and Development programs. Compliance to the treaty and congruence with the national policies of the government have to be considered in strategizing for better germplasm conservation, exchange and its use to achieve the Vision and Mission of COGENT.

ANNEX 5 Message to COGENT@30 from Professor Gabrielle Persley,

University of Queensland, Australia

November 12, 2022

Dear COGENT Members and Friends of Coconut

Congratulations on achieving a significant anniversary – and celebrating 30 years since the establishment of COGENT as an international network for coconut genetic resources, in 1992. Special congratulations and appreciation for their hard work and dedication are due to the work of the many members of the COGENT Steering Committee, the COGENT Coordinators and the Coconut donor support group, who supported COGENT over the three decades.

Appreciation and many thanks also to the support provided to COGENT by its hosting organizations. COGENT has been hosted by just two organizations over its life span: from its beginning in 1992, COGENT was hosted by Bioversity International (and its predecessors) as part of the Consultative Group on International Agriculture (CGIAR), who played an important role in the establishment of COGENT. More recently, COGENT has come of the auspices of the International Coconut Community (ICC), who are now taking COGENT into a new era, closely associated with the broader coconut community and the recognition of the global importance of coconut.

For the future, there are three components of COGENT's work on genetic resources that are critical – to ensure:

(1) **Collection and conservation**, to collect and safely conserve the wide variety of coconut genetic resources for future generations.
(2) **Characterization**, including molecular characterisation, identifies coconut varieties that demonstrate climate resilience, improved productivity, and/or are suitable to produce value added products to improve the sustainability and profitability of coconut.
(3) **Utilization**, to make the wide range of genetic resources more readily available to coconut farmers, including through access to affordable, high quality planting material of farmer preferred varieties, to enable replanting of older trees in many countries and environments.

These are challenges for COGENT in its next decade, but with the dedication and support of its members and friends of coconut, these challenges will be met.

I wish you a successful event today, to celebrate COGENT@30, and best wishes to all COGENT members for your future endeavours.

Kind regards

Professor Gabrielle Persley AM

School of Agriculture

University of Queensland

ANNEX 6: Message from Dr Alexia Prades

Dear COGENT members,
Dear Erlene Manohar, COGENT coordinator,
Dear Jelfina Alouw, ICC ED,
Dear colleagues,
Ladies and gentlemen,

It is a real pleasure and honour for me to offer a few words on the COGENT's 30th anniversary - I thank you for this invitation.

Since its creation in 1992 after a workshop of the IBPGR (International Board for Plant Genetic Resources) held in Cipanas, Indonesia in October 1991, for 30 years COGENT has maintained a living link between the 5 international collections, the 19 national collections and the communities that keep them alive.

As former COGENT coordinator and as a French scientist working at CIRAD, I am very honoured to be part of the lineage of people who have been entrusted with this global network, which has evolved and endured.

In 30 years, there have been good times and more difficult times when, as in 2015, strong decisions had to be made. I am proud to have been able to initiate with the unconditional support of the late Mr Uron Salum, former ICC CEO, with the vice chairman at that time, Dr Lalith Perera, with the agreement of Bioversity International and the help of ITPGRFA Secretariat at FAO, the transfer of the coordination of the network and international collections from CGIAR to ICC. Both CGIAR and ICC are international organizations closely linked to the United Nations and I know that the values they hold have ensured and will assure the future for COGENT.

Each variety, each accession planted in the COGENT field genebanks is the result of the combined actions of nature and human beings who have patiently, over the last millennia, selected coconut trees for their various uses. They have been carefully characterized and studied by dozens of scientists over the world. These coconut genebanks and associated data are therefore a real treasure gathered in the 1200 ha of collections spread over the 5 continents.

I would like to underline the incredible work done by the host countries of these collections and the researchers of these countries and COGENT to preserve this treasure. For yes, these international and national collections are a treasure for humanity that we must preserve, cherish and share. Sharing to ensure a future for future generations in a world in turmoil.

I wish all the members of the COGENT network another happy anniversary. May the coming years allow us to consolidate and develop this international network whose role is crucial because it is in the diversity and the sharing of this diversity that lies the capacity of our countries to respond to the challenges of our world in transition.

Alexia PRADES, Montpellier, France, CIRAD, 11th November 2022

ANNEX 7: 2022 DRAFT SC RECOMMENDATIONS

RECOMMENDATION 1: Align COGENT's strategy with that of ICC strategy efficiently oriented towards consumers & processors. To be fully coherent, the COGENT strategy should be complementary to that of ICC.

The first action is to fully integrate COGENT activities within the ICCs program and policies by:

i) ensuring the congruence of COGENT's program to ICC's mandate
ii) ICC to provide the necessary resources for COGENT to operate
iii) Direction setting geared towards support to the major concerns of the industry harmonizing policies and plan as ICC program

RECOMMENDATION 2: Institutionalize COGENTs collaboration with private sector, research agencies and coconut farming smallholders harmonized within the policies of ICC.

i) Encourage greater cross collaboration between ITAGs and among member countries and host countries.
ii) Develop the framework for interactions between ITAGs, including ratifying ITAGs TORs
iii) Adopt the public-private partnership, engage other research institutions in the planning and formulation of strategies
iv) R & D alliances establishment of networks/linkages

RECOMMENDATION 3: Upgrade and align COGENT membership with ICC policy-making level for more agency.

i) Review of the membership and institutionalize within the higher level of policy making
ii) Harmonize COGENT's membership guidelines with the policies of ICC
iii) Revive the consideration of having a co-leadership of ITAG with 1 senior/1 junior expert.

RECOMMENDATION 4 Complete and implement ITAGs' process of crafting the 5-year work program and investment plan to generate sustainable funding for ITAGs through the Crafting of the Road Map

i) COGENT to convene ITAGs quarterly for virtual meetings on mutually agreed dates preferably end of the quarter.
ii) ITAG's list of prioritized research projects linked to the Strategy with the support of ICC
- ITAG1 will focus on ICG-related conservation management matters;
- ITAG 2 consolidating genomics & breeding links;
- ITAG 3 Biosecurity planning & conducting a survey/ review of (proven) diagnostic tools;
- ITAG 4 compile links to all Tissue Culture and Cryopreservation laboratories

iii) These priority projects will form the basis of renewed resource mobilization/ proposal development.
iv) ITAG members/team leaders contribute to developing COGENT Strategy implementation plan & budget.

RECOMMENDATION 5: Conduct consultative meetings with decision makers of genebank host countries to address causes of non-compliance to the ITPGRFA.

i) ensure fund support in the management of ICGs from host country
ii) assists in reviewing & renewing Article 15- ICG hosting agreements with the 5 ICGs.
iii) developing coconut germplasm data management system
iv) crafting business plan for the income-generating activities for support to the operations of ICGs

Appendix 8: COGENT proposals pipeline April 2020 to May 2021

	Proposal type	ITAG	Donor	Dev elopi		lead applicant	deadline	date submitted	amount (US$'000)	Title
1	Phase 1	Genomics & Breeding	CHINA	P	S	CATAS	30/04/2020	30/04/2020	285	Cooperative Research on Pan-tropical Population Genetic Diversity of Coconut Based on Pan-genome Analysis
2	EOI phase 1	Conservation	USAID	R	S	ICC	03/04/2020	02/04/2020	not specified	piloting & mainstreaming broader genetic diversity, with sustainable climate-change adaptation, coconut-linked food-system and poverty-reduction interventions, Côte d'Ivoire, Kenya, & Tanzania
3	CN-phase 1	Conservation	Science for Nature and people partnership (SNAPP)	R	S	ICC	10/06/2020	08/06/2020	200	Biodiversity conservation modeling to promote sustainable development in poor coconut-growing communities
4	bespoke	Phytopathology/ Germplasm Movement	CABI	D	D	ICC or CNRA Cote d'Ivoire	n/a	n/a	not specified	Biosecurity planning for ICGs
5	bespoke	Phytopathology/ Germplasm Movement	??	D	D	ICC or Cirad	n/a	n/a	not specified	Thermotherapy treatments to disinfect coconut germplasm
6	bespoke	ICC health & Nutrition	multi-donor	D	D	ICC	n/a	n/a	300	Randomized Clinical Trial on the Use of Virgin Coconut Oil (VCO) and Monolaurin Taken Orally Against COVID-19
7	EOI phase 1	ICC health & Nutrition	Canada, IDRC	R	S	TARI/KALRI	26/06/2020	26/06/2020	650	Coconut to increase food systems resilience to pandemic shocks, + ensuring increased market competitiveness/demand for healthy & sustainable food. Kenya, & Tanzania
8	phase 1	ICC health & Nutrition/COGENT Conservation	SDC_	R	S	ICC-Bioversity-CIAT	28/08/2020	n/a	10,000.0	Biodiversity in support to nutrition
9	phase 1	TC& Cryo	EU	D	D	ICC-Bioversity-CIAT	28/08/2020	n/a	tbd	Cryopreserving backup priority coconut accessions for the global collection
10	Invited MoA	ICC	ITC	P	S	ICC	ASAP	12/11/2020	30.0	capacity building webinars and support for COCOTECH, CRI training
11	Phase 1	ICC	German Gov/ BMU	D	D	ICC-Bioversity-CIAT	10/03/2021	n/a	5-20 million	International Climate Initiative (IKI)BMU): *From pilot to application: expanding climate-conscious & biodiversity-friendly land use & production*
12	Phase 1	ICC	EU, Horizon 2020	D	D	ICC-Bioversity-CIAT	26/01/2021	n/a	3- 5 million €	Developing end-user products and services for all stakeholders and citizens supporting climate adaptation and mitigation.
13	Phase 1	ICC	EU, Horizon 2020	D	D	ICC-Bioversity-CIAT	26/01/2021	n/a	16-25 million €	Restoring biodiversity and ecosystem services.
14	Phase 1	ICC	EU, Horizon 2020	D	D	ICC-Bioversity-CIAT	26/01/2021	n/a	6-12 million €	Testing and demonstrating systemic innovations in support of the Farm-to-Fork Strategy
15	Phase 1	ICC	London School of Hygiene & Tropical Medicine (LSHTM), IMMANA	D	D	ICC-Bioversity-CIAT	21/01/2021	n/a	1.4	Develop and Validate Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA).
16	EOI phase 1	Phytopathology/ Germplasm Movement	Gates Foundation, , Global Grand Challenges: Smart Farming Innovations for Small-Scale Producers	S	P	ICC	25/02/2021	25/02/2021	1,500.0	DIGICOCO: Smart Pest-Control Innovations for Small-Scale Coconut Producers
17	Phase 1	Genomics & Breeding	CHINA	S	p	CATAS	30/04/2020	30/04/2021	285.0	Cooperative Research on Pan-tropical Population Genetic Diversity of Coconut Based on Pan-genome Analysis (resubmission of 2020 CN)
18	Phase 1	Phytopathology/ Germplasm Movement	GIZ Innovation Challenge 2021 - Advisory for Agroecology: Integrating agroecological approaches into agricultural advisory services	S	R	CABI	31/05/2021	31/05/2021	150.0	HOLISTICOCO: Increasing yields for small-scale coconut producers in Africa through an integrated crop health, production and extension system
									11,966.4	

Appendix 9: Project expenditure

Australian Government
Australian Centre for
International Agricultural Research

ACIAR Acquittal

USD to AUD 31/12/22 1.49

[please complete all cells highlighted in orange only, then sign as directed at the bottom of the form]

Reporting Period:

Commissioned Organisation: International Coconut Community
Project Number: GP/2018/193

1 Jan 2020 to 31 Dec 2022
International Coconut Community
GP/2018/193

Set out below is a statement of available funds and expenditure: (prepared on a Cash Basis) A$

A. Available Funds:

Carried Forward (Funds Unspent/Overspent) from previous period^		$0.00
Total Project Payment received for this period		$455,623.79
	TOTAL A	$455,623.79

^ previous period = the six-month period immediately preceding the payment period
^^ payment no. = the scheduled payment number in the Project Budget

B. *Less* Expenditure:

Commissioned Organisation Expenditure

Personnel	$128,391.59
Research Operating Expenses	$230,551.63
Travel	$87,221.95
Capital	$17,306.49
Infrastructure	$24,449.13
Sub-Total	$487,920.79

Payments to Project Collaborators* (hide/unhide rows as required)
This section is optional for Small Research Activities (SRAs)

	Payment Number^^	Collaborator Acquittal received for *previous* period^	
SPC - Payment Number	GVD-2021-12-13	YES	$5,862.30
Bioversity-CIAT Alliance	GVD-2021-08-06	YES	$8,044.17
		Sub-Total	$13,906.47
		TOTAL B	$501,827.26

*List ALL project collaborators in the table above along with the relevant payment number and amount paid to them during the reporting period. If no payments were made insert $0. Include an explanation in Part F: Other Comments below if payment amounts differ to the budget schedule. Indicate (Y/N) whether the Collaborator submitted an acquittal for the ^previous reporting period. If no acquittal was received, please provide a reason in Part F. Other Comments.

C. Funds Unspent/(Funds Overspent): **TOTAL C** **-$46,203.48**

FUNDS OVERSPENT - If overspend >20% of Available Funds, please provide an Explanation in Part F. Other Comments

Funds Unspent must be categorised into Committed (Part D) and Uncommitted (Part E)
Committed Funds are funds for goods, services & personnel costs that have **already been delivered in the reporting period**, but invoices have not yet been paid or received.
Uncommitted Funds = **Funds Unspent** less **Committed Funds**

Committed Funds (complete Part D)	**$0.00**
Uncommitted Funds (provide explanation in Part E)	**-$46,203.48**

These totals will update as Parts D & E are completed

D. Committed funds:

Committed Funds are funds for goods, services and personnel costs that have already been delivered in the reporting period, but invoices have not yet been paid or received.
Do not include funds for activities budgeted for in the next payment period.

Committed Funds for Commissioned Organisation		
Personnel		$0.00
Research Operating Expenses		$0.00
Travel		$0.00
Capital		$0.00
Infrastructure		$0.00
Committed Funds for Collaborator Payments (hide/unhide rows as required)		
		$0.00
	TOTAL D	**$0.00**

E. Explanation for Uncommitted Funds:

Provide comments regarding Uncommitted Funds below	**TOTAL E**	**-$46,203.48**
Final period of Project GP/2018/193 (consolidated report)		
OPTIONAL Itemised explanation for Uncommitted Funds (hide/unhide rows as required):		
	Total	**$0.00**

Contact the relevant Research Program Manager to discuss any plans to reallocate Uncommitted Funds to new project activities.

F. Other Comments:

Provide details regarding: (i) Reasons for Funds Overspent greater than 20% of Available Funds
(ii) Collaborator payment not made and/or collaborator acquittals not received; or (iii) Any other relevant information.

Completion report of Project GP/2018/193. Uncommitted funds are utilized in compensation of final payment from ACIAR of AUD 20,000

G. Certification

I certify that the expenditure shown above is correct and has only been spent on the specified project:

Signed and dated by Project Leader:	Signature:	[signature]
	Print name:	Jelfina C. Alouw
	Date:	17/04/2023

Signed and dated by Authorised Officer preparing this acquittal:	Signature:	[signature]
	Print name:	Mridula Kottekate
	Date:	17/04/2023

Project Acquittals without signatures can not be accepted

Please email a PDF of completed acquittal to researchPSO@aciar.gov.au
Acquittals are due no later than 30 days after the expiration of each Payment Period.
Commissioned Organisations will be contacted if additional information is required.

*Rate based on the average of sell and buy in Bank Indonesia rate

Appendix 10: Rolling Project workplan

				0				1						2						3						4						5												
Activity	Event	period	month	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	comments
Meetings	intial planning meeting 2020 (completed)	1																																										completed
	ICC-COGENT virtual meetings (ongoing/ completed)	1 to 3																																										ongoing
	first virtual overarching ITAG meeting (completed)	1																																										TBD for 26-30 May
	first virtual SC meeting 2020 (completed)	1																																										suggest 8-11 June-
	monthly ITAG virtual meetings (4 completed by Jan 2021)	1																																										TBD
	first physical ITAG + SC meeting 2022 back to back COCTECH (Malaysia?) 7-11	4																																										1st half feb 2021
	possible Genomics ITAG meeting CATAS China(Chinese funds)	5																							??																			possibly June 2021 after Brazil visit?
	ITAG+ SC meeting + End of Project meeting (Indonesia/ Brazil or Cote d'Ivoire?) 2022	3																																										TBD depends if get extension
Training	TC symposium 2021, CICY Mexico	4																																										moved to India, with virtual symposium
	Virtual database training (best to start after some ICG appraisals/ just b4 Malaysia meeting)	4 to 3																																										introductory session then some extra virtual sessions
	database training 2021, Malaysia	4																																								with SC me		TBD now to be scheduled for 2023
	In vitro embryo culture 2021, India	5																																	SAME follow up									May 2022 with ICG appraisal
ICC events (not in project budget)	COCOTECH 49 (deferred)	4																							prep																			moving COTECH to Feb 2021
	56 Samoa session (held virtually)	2														prep																												keeping Session 23-27 Nov
	IPM, Philippines (unsure when- possibly in Aug 24-26 when coco week)	5																									2 days																	TBD
	ICC international-training- CDOs (virtual March-April)	5																					inaug		wrapup																			postponed
	World Coconut Congress (Pjhilippines aug	2																																										as is 27-29 Aug 2020
	Quality standards Jul 13-15 2021 (Indonesia)	5																																										
	ICC-ED- COCOTECH prep visit Malaysia 7-11 Sept	4																																										completed
ICGs /ICG appraisals	SEA, Indonesia (April)	5																																										October 2020?
	SAME, India (Sept onwards- Dec)	4																																										with invitro symposium March 2021
	AIO, Cote d'Ivoire (Jan 2021)	2 to 5																																										start of dry season
	AIO, Cote d'Ivoire - phytosanitary survey/ biosecurity planning (separate CABI proposal- possible ITAG phytopathology meeting)- TBD after appraisal in January 2021	4																																										discuss sustainability plan and biosecurity during visit
	LAC, Brazil (Feb-Mar 2022)	3																																										start of dry season
	SP, PNG	1																																										broadly same
	preparation for CGRD migration	5 to 3																																										broadly same
	CGRD migration	4 to 3																																										broadly same
	State of Coconut genetic resources report compilation	2 to 3																																										starting compilation later
	State of Coconut genetic resources report finalised/published	3																																										aiming to publish same dates
Global GR Strategy implementation budgeting &	establishing ITAGs (leader and members)	1 to 2																																										slight delay
	develop budget & workplan	5 to 4																																										slight delay
	begin implementation	1 to 3																																										slight delay
Developing self-sustaining ICG and COGENT mechanisms	ITAGs list priority projects	1																																										slight delay
	ITAGs develop priority project proposals	2 to 3																																										slight delay
	ITAGs priority projects donor funding on-stream	4 to 3																																										possible slight delay
	Develop industry-based / gov. / int. support for COGENT projects, incl. ITAG activities linked to resource mobilization	2 to 3																																										slight delay
	industry-based / gov. / int. support for COGENT projects established	4 to 3																																										slight delay
	Facilitate genebanks in developing business models for self-sustaining	5 to 3																																										slight delay
	ICG business models developed	4 to 3																																										slight delay
	ICG business models operating	3																																										
HR	Recruit Coordinator	5																																										slight delay
	Liaison with SPC Assisting coordinator (and develop rlinks to other regios' assiting coordination	1 to 3																																										slight delay
COGENT Communications	Review current COGENT website	1																																										slight delay
	Migrate COGENT website from Bioversity to ICC	1																																										slight delay
	develop new website	5																																										slight delay
	establish newsletter structure	1																																										completed
	issue annual newsletters	1 to 3																																				~						underway
M&E and reporting	Financial reports	1 to 3																																										
	Technical reports	1 to 3																																										
	Monitoring progress reviews	1 to 3																																final										
	Evaluation	1 to 3																																										

Activity	Event	period	Timeline notes	comments
Meetings	intial planning meeting 2020 (completed)	1		completed
	ICC-COGENT virtual meetings (ongoing/ completed)	1 to 5		ongoing
	first virtual overarching ITAG meeting (completed)	1		TBO for 26-30 May
	first virtual SC meeting 2020 (completed)	1		suggest 8-11 June-
	monthly ITAG virtual meetings (4 completed by Jan 2021)	1		TBO
	first physical ITAG+SC meeting 2022 back to back COCTECH (Malaysia?) 7-11	4		1st half feb 2021
	possible Genomics ITAG meeting CATAS China(Chinese funds)	5	>>	possibly June 2021 after Brazil visit?
	ITAG+SC meeting + End of Project meeting (Indonesia/ Brazil or Cote d'Ivoire?) 2022	5		TBO depends if get extension
Training	TC symposium 2021, CICY Mexico	4		moved to India, with virtual symposium
	Virtual database training (best to start after some ICG appraisals/ just b4 Malaysia meeting)	4 to 5		introductory session then some extra virtual sessions
	database training 2021, Malaysia	4	with SC me	TBO now to be scheduled for 2023
	In vitro embryo culture 2021, India	5	SAME follow up	May 2022 with ICG appraisal
ICC events (not in project budget)	COCOTECH 49 (deferred)	4	prep	moving COTECH to Feb 2021
	56 Samoa session (held virtually)	2	prep	keeping Session 23-27 Nov
	IPM, Philippines (unsure when- possibly in Aug 24-26 when coco week)	5	2 days	TBO
	ICC international-training- CDOs (virtual March-April)	5	inaug; wrap up	postponed
	World Coconut Congress (Pjhilippines aug	2		as is 27-29 Aug 2020
	Quality standards Jul 13-15 2021 (Indonesia)	5		
	ICC-ED- COCOTECH prep visit Malaysia 7-11 Sept	4		completed
ICGs /ICG appraisals	SEA, Indonesia (April)	5		October 2020?
	SAME, India (Sept onwards- Dec)	4		with invitro symposium March 2021
	AIO, Cote d'Ivoire (Jan 2021)	2 TO 5		start of dry season
	AIO, Cote d'Ivoire - phytosanitary survey/ biosecurity planning (separate CABI proposal- possible ITAG phytopathology meeting)- TBD after appraisal in January 2021	4		discuss sustainability plan and biosecurity during visit
	LAC, Brazil (Feb-Mar 2022)	5		start of dry season
	SP, PNG	1		broadly same
	preparation for CGRD migration	5 to 5		broadly same
	CG RD migration	4 to 5		broadly same
	State of Coconut genetic resources report compilation	2 to 5		starting compilation later
	State of Coconut genetic resources report finalised/published	5		aiming to publish same dates
Global GR Strategy implementation budgeting &	establishing ITAGs (leader and members)	1 to 2		slight delay
	develop budget & workplan	5 to 4		slight delay
	begin implementation	1 to 5		slight delay
Developing self-sustaining ICG and COGENT mechanisms	ITAGs list priority projects	1		slight delay
	ITAGs develop priority project proposals	2 to 5		slight delay
	ITAGs priority projects donor funding on-stream	4 to 5		possible slight delay
	Develop industry-based / gov. / int. support for COGENT projects, incl. ITAG activities linked to resource mobilization	2 to 5		slight delay
	industry-based / gov. / int. support for COGENT projects established	4 to 5		slight delay
	Facilitate genebanks in developing business models for self-sustaining	5 to 5		slight delay
	ICG business models developed	4 to 5		slight delay
	ICG business models operating	5		
HR	Recruit Coordinator	5		slight delay
	Liaison with SPC Assisting coordinator (and develop links to other regios' assiting coordination	1 to 5		slight delay
COGENT Communications	Review current COGENT website	1		slight delay
	Migrate COGENT website from Bioversity to ICC	1		slight delay
	develop new website	5		slight delay
	establish newsletter structure	1		completed
	issue annual newsletters	1 to 5	~	underway
M&E and reporting	Financial reports	1 to 5		
	Technical reports	1 to 5		
	Monitoring progress reviews	1 to 5	final	
	Evaluation	1 to 5		