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The International Coconut Genetic Resources Network (COGENT): its history, achievements and future plans

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Abstract

The Coconut Genetic Resources Network (COGENT) was established in 1992 by the International Plant Genetic Resources Institute (IPGRI) under the aegis of the Consultative Group on International Agricultural Research (CGIAR). To date it has made some modest achievements. It has successfully developed and disseminated worldwide the International Coconut Genetic Resources Database (CGRD) containing passport and characterisation data and images of 1,416 accessions which are conserved by national programs in 28 sites in 23 countries. To provide double security for the conserved germplasm and a more effective mechanism for access and safe germplasm movement, it established the COGENT multisite International Coconut Genebank (ICG), which conserves, evaluates and shares about 200 important accessions in each of five geographic regions. Coconut varieties with multipurpose uses are being identified, documented, conserved and promoted in 15 countries. The performance of high-yielding hybrids and farmers' varietal preferences in nine countries are being evaluated. To strengthen the coconut research capability of member countries of COGENT, 39 country needs assessment missions were conducted. Also, 41 workshops and meetings involving 994 coconut researchers, 40 training courses involving 765 participants from 41 countries, and 274 research and training and capacity-building activities in 30 countries were supported. To enhance the efficiency of global research, COGENT helped establish and is currently coordinating the Global Coconut Research for Development Programme (PROCORD), a global coconut research alliance with the Asian and Pacific Coconut Community (APCC) and Bureau for the Development of Research on Tropical Perennial Oil Crops (BUROTROP), Centre de Coopéracion Internationale en Recherche Agronomique pour le Développement (CIRAD).

In the near future COGENT plans to upgrade its CGRD, rationalise its coconut conservation strategy, and upgrade its embryo in-vitro culture and somatic embryogenesis technologies. It will also identify, test and share germplasm with resistance to phytoplasma-caused diseases, and support a globally coordinated coconut breeding program. To enhance incomes of poor coconut farmers and conserve germplasm in situ and on farm, it will continue its 'poverty reduction in coconut growing communities' project and expand it in the African and Latin American and Caribbean regions. It will accelerate its capacity-building activities and strengthen its partnership collaboration with developing and developed countries.

History

COGENT is a global research network established under the aegis of the Consultative Group on International Agricultural Research (CGIAR). The international initiative on coconut (*Cocos nucifera*) research was first discussed at the 1989 meeting in Bangkok of the Asian and Pacific Coconut Community (APCC).

In 1989 the Technical Advisory Committee (TAC) of CGIAR commissioned studies to identify:

- priority problems that affect coconut production
- problems that could be addressed through research

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- new approaches to address those researchable issues that are international in character and beyond the capacity of any one country to resolve.

Based on these studies, the problems identified by CGIAR as suitable for international research support are:

- germplasm collecting, conservation, evaluation and enhancement
- pest and disease control, especially lethal diseases
- improving the productivity and sustainability of coconut-based farming systems
- increasing efficiency and added value in post-harvest handling and utilisation
- addressing socioeconomic issues such as the factors that influence farmers' varietal choices in replanting coconut land.

These studies revealed that higher incomes for poor coconut farmers could result from investment in international coconut research.

With the encouragement and support of the International Plant Genetic Resources Institute (IPGRI), a workshop involving 15 countries was held in 1991 in Cipanas, Indonesia. The participants recommended the establishment of an international network of coconut genetic resources. Dr Gabrielle Persley, then working with the Australian Centre for International Agricultural Research (ACIAR), devoted a great deal of time and effort to convince CGIAR and other donors to support international coconut research, and in 1992 CGIAR decided to include coconut in its research portfolio. Shortly thereafter, IPGRI organised COGENT and included coconut in its research program. Starting with 15 member countries, COGENT membership has grown to include 38 coconut producing countries to date (Table 1).

The goals of COGENT are to improve coconut production on a sustainable basis and to increase incomes in developing countries through improved cultivation of the coconut and efficient use of its products and by-products. The objectives of COGENT are to:

1. establish an international database on existing and future coconut germplasm collections
2. encourage the protection and use of existing germplasm collections
3. identify and secure additional threatened diversity by developing and adopting suitable conservation technologies and strategies
4. promote greater collaboration among research groups in producer countries and advanced technology sources in the exchange of germplasm and the development of new conservation techniques
5. secure necessary funding for network activities
6. conduct appropriate training and information dissemination.

To achieve the above-mentioned goals and objectives, IPGRI established a COGENT Steering Committee (SC) that decides on priority activities and provides oversight during implementation. The SC consists of two representatives in each of five geographical regions plus the Executive Director of the APCC and the COGENT Coordinator, with the last two serving as non-voting members. COGENT has five regional subnetworks, a Country Coordinator in every member country and Country Project Leaders designated to manage each country project.

Table 1. COGENT member countries from the five major coconut-growing regions of the world

South-East and East Asia	South Asia	South Pacific	Africa and Indian Ocean	Latin America and Caribbean
China	Bangladesh	Cook Islands	Benin	Brazil
Indonesia	India	Fiji	Cote d'Ivoire	Colombia
Malaysia	Pakistan	Kiribati	Ghana	Costa Rica
Myanmar	Sri Lanka	Papua New Guinea	Kenya	Cuba
The Philippines		Solomon Islands	Madagascar	Guyana
Thailand		Tonga	Mozambique	Haiti
Vietnam		Vanuatu	Nigeria	Honduras
		Samoa	Seychelles	Jamaica
			Tanzania	Mexico
				Trinidad–Tobago

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Table 2. COGENT's international coconut genetic resources database

Site	No. of accessions	25<P75[a]	25<E75[b]	With images[c]	With molecular data[d]
CNRA Marc Delorme Research Station, Port-Bouët, Côte d'Ivoire	99	92	71	73	67
Coconut Programme, OPRI, Sekondi, Ghana	16	–	4	15	14
CRC, Sémé Podji, Benin	4	4	4	4	3
National Coconut Development Programme, Dar es Salaam, Tanzania	72	71	69	35	33
African region	191	103	148	127	117
Centro de Investigacion Cientifica de Yucatan, Merida, Mexico	20	20	1	1	2
Coconut Industry Board, Kingston, Jamaica	60	16	58	32	36
EMBRAPA, Aracaju, Betume-Brazil	16	16	16	10	10
Latin American – Caribbean region	96	52	75	43	48
BARI, Gazipur, Bangladesh	40	18	37	–	–
Coconut Research Institute, Lunuwilla, Sri Lanka	78	78	64	5	10
CPCRI, Kasaragod, India	212	141	211	76	52
RS, Islamabad, Pakistan	32	–	–	–	–
South Pacific region	362	237	312	81	62
Cocoa and Coconut Institute, Rabaul, Papua New Guinea	3	–	3	5	30
Stewart Research Station, Madang, Papua New Guinea	54	31	54	3	2
Ministry of Agriculture, Nuku'alofa, Tonga	7	–	1	2	2
Saraoutou Research Station, Santo, Vanuatu	79	71	11	48	53
Taveuni Coconut Centre, Taveuni, Fiji	11	8	7	5	5
Olomanu Coconut Seed Garden, RS, Apia, Samoa	9	–	9	4	3
RS, Yandina, Solomon Islands	21	4	21	10	11
South Asian region	184	114	106	77	106
Coconut Research Institute, Wenchang, China	17	15	17	–	14
Department of Agriculture, Sabah, Malaysia	45	23	30	23	19
MARDI, Hilir, Perak and Terengganu, Malaysia	44	34	39	40	38
Bone Bone Experimental Garden, Manado, Indonesia	41	35	41	–	–
Mapanget Experimental Garden, Manado, Indonesia	74	74	45	14	17
Pakuwon Experimental Garden, West Java, Indonesia	25	22	25	8	10
Sikijang Experimental Garden, Pekanbaru, Indonesia	30	30	30	3	5
Philippine Coconut Authority, Zamboanga, the Philippines	224	221	219	194	51
Chumphon Horticultural Research Centre, Chumphon, Thailand	52	42	52	9	8
Dong Go Experimental Center, Ben Tre, Vietnam	31	30	16	9	8
South-East Asian region	583	526	514	300	170
Total for all regions	1,416	1,032	1155	628	503

[a] number of accessions with 25–75% of full passport data
[b] number of accessions with 25–75% of full evaluation data
[c] number of accessions with images
[d] number of accessions with molecular marker data generated using micro-satellite kits

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Achievements

In the last 15 years COGENT has made some modest achievements thanks to the support of its member countries, partner institutions, CGIAR and donors; and to the effective administrative and technical backup provided by IPGRI, the executing agency for the network (Batugal et al. 2005). It has successfully developed and disseminated worldwide the International Coconut Genetic Resources Database (CGRD), containing passport and characterisation data and images of 1,416 accessions which are conserved by national programs in 28 sites in 23 countries (Table 2). To provide double security for the conserved germplasm and a more effective mechanism for access and safe germplasm movement, it established the COGENT multisite International Coconut Genebank (ICG), which will conserve, evaluate and share about 200 important accessions in each region. The regional gene banks are managed by the national coconut programs of India, Indonesia, Papua New Guinea and Côte d'Ivoire, with Brazil recently agreeing to host the ICG for the Latin American and Caribbean region. Coconut varieties with multipurpose uses are being identified, documented, conserved and promoted in 15 countries. The performance of high-yielding hybrids and farmers' varietal preferences in nine countries was evaluated in collaboration with APCC and the Bureau for the Development of Research on Perennial Tropical Oil Crops (BUROTROP); and the performance of 38 promising high-yielding hybrids was evaluated in four African and three Latin American/Caribbean countries to identify suitable varieties and hybrids for resource-poor farmers.

To promote in-situ and on-farm conservation of farmers' varieties, COGENT has been implementing a diversity-linked poverty reduction project in 54 coconut growing communities in 15 countries. This strategy has demonstrated that farmers' incomes can be increased three to five times. The effect on women was particularly significant, with formerly destitute and underemployed women now earning up to US$3/day. Families are now working together, which contributes to social cohesiveness, social recognition and self esteem, especially for women. Food security and income can be enhanced and precious coconut genetic resources can be conserved (Batugal and Coronel 2004; Batugal and Oliver 2004, 2005). Protocols are being developed, tested and upgraded for in-vitro embryo culture, cryopreservation, morphometric and molecular marker-based methods for locating and characterising diversity, pest risk assessment and germplasm health management. Strategies and techniques for farmer participatory research, collecting, characterisation, and ex-situ and in-situ conservation are being refined.

To strengthen the coconut research capability of COGENT member countries, 39 country needs assessment missions were conducted. Also, 41 workshops and meetings involving 994 coconut researchers, 40 training courses involving 765 participants from 41 countries, and 274 research and training and capacity-building activities in 30 countries were supported. To enhance the efficiency of global research, COGENT helped establish and is currently coordinating the Global Coconut Research for Development Programme (PROCORD), a global coconut research alliance with APCC and BUROTROP – Centre de Coopéracion Internationale en Recherche Agronomique pour le Développement (CIRAD).

Plans for the future

To further enhance its achievements in the last 15 years, COGENT plans to undertake the following priority activities:

1. ***International Coconut Genetic Resources Database (CGRD)***—COGENT will enhance the generation of more morphometric and molecular maker data for the 1,416 accessions conserved in 23 countries; release the CGRD in the public domain; and link with System-wide Information Network for Genetic Resources (SINGER), the CGIAR genetic resources database.
2. ***rationalisation of coconut conservation***—COGENT will develop and implement more harmonised global, regional and national conservation strategies to make conservation efficient and cost-effective. These strategies will be developed by and promoted in COGENT member countries.
3. ***International Coconut Genebank (ICG)***—COGENT will enhance the full development of the ICG by formally establishing the Latin American – Caribbean ICG to be hosted by the Government of Brazil; conserving a total of about 200 representative accessions in each of the five ICG host countries; characterising these conserved germplasm; and sharing both data and germplasm with coconut growing countries of each region.

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4. ***complementary conservation***—COGENT will further develop and refine complementary conservation technologies and strategies to make them efficient and cost-effective, i.e. field gene banks, in-vitro and in-situ/on-farm.
5. ***embryo culture and somatic embryogenesis***—To increase the efficiency of embryo culture techniques for germplasm collecting and embryo rescue in high-value soft-endosperm coconut varieties, COGENT will provide further support to improving embryo culture technology. To enhance efficiency of propagation and provide parental materials to breeders in adequate numbers and at affordable cost, it will support research to increase somatic embryogenesis efficiency.
6. ***disease resistant germplasm***—COGENT will identify germplasm with resistance to phytoplasma-caused diseases, e.g. lethal yellowing, root wilt.
7. ***globally coordinated coconut breeding—***To accelerate the development of improved coconut varieties which are acceptable to farmers, COGENT will support the breeding efforts of national programs and develop suitable breeding networks for countries with similar objectives.
8. ***poverty reduction in coconut growing communities***—To enhance the conservation of farmers' varieties and improve the incomes and livelihoods of resource-poor coconut growing communities as a strategy for in-situ/on-farm conservation, COGENT will expand its diversity linked poverty reduction project from 15 to 25 countries worldwide in the next 5 years.
9. ***capacity building***—To further enhance the research capacity of member countries, COGENT will continue to provide training, technical assistance missions and strategic publications and public awareness materials to national research programs worldwide.
10. ***regional subnetworks and partners—***To increase research collaboration at the regional level, COGENT will continue to strengthen its five regional networks and continue its collaboration with APCC, the Secretariat of the Pacific Community (SPC) and similar regional organisations in the African and Latin American – Caribbean regions.
11. ***PROCORD***—To increase the deployment of conserved diversity in the programs of partner institutions, COGENT will enhance the full implementation of PROCORD in collaboration with APCC and CIRAD.

To support the above activities, new funding has been generated from the Global Crop Diversity Trust, the International Fund for Agricultural Development (IFAD), the Department for International Development of the United Kingdom (DFID) and the Government of Brazil. COGENT will continue to effectively liaise with and seek support from COGENT member countries, partner institutions and donors.

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