

Rejuvenating coconut sector for improving livelihood security*

Coconut, a versatile tree crop, plays an important role in ensuring food and livelihood security to millions of people in tropical countries, in addition to providing invaluable ecosystem services. Coconut research in India began with the establishment of the Coconut Research Station in 1916 by the Madras Presidency. The milestone research achievements include discovery of hybrid vigour (1932), light interception and root-spread studies (that resulted in the development of cropping system models), development of pest/disease management strategies, and protocols for embryo culture and cryopreservation of embryos and pollen, processing protocol for novel coconut food products, etc. The post-World Trade Agreement (WTA) and ASEAN Treaty regime witnessed integration of coconut economies across the globe that resulted in fierce competition among the coconut-producing countries. Enhancing farm-level income through adoption of competitive and sustainable production techniques, product diversification and demand creations for coconut products are the need of the hour. It is a matter of serious concern that despite economic, nutritive and health contributions of coconut, its farming across the world has become less profitable in recent years. It is pertinent to note that the failure to respond to changing patterns of the world trade in coconut products will have an adverse effect on the employment and revenue of the major coconut-producing countries in the Asia-Pacific region. Therefore, it is important to define the factors that drive international coconut markets, identify threats to the sector and accordingly reorient the research and developmental activities of the major institutions across the world. Keeping these points in view, the 3rd International symposium on coconut research and development was organized.

The symposium started with a welcome address by P. Chowdappa (ICAR-

Central Plantation Crops Research Institute (CPCRI), Kasaragod). Trilochan Mohapatra (DARE and ICAR) inaugurated the symposium and stressed upon genomic research to accelerate breeding and disease management. Uron N. Salum (Asia Pacific Coconut Community (APCC), Jakarta), in his address, applauded the Government of India, ICAR-CPCRI and Indian coconut farmers for organizing various programmes for commemorating the centenary of coconut research in India. Efforts of the Coconut Development Board (CDB) in promoting coconut producer companies for realizing better income for coconut farmers through adoption of scientific cultivation practices and value-addition were described by A. K. Singh (CDB, Kochi, India). P. K. R. Nair (University of Florida, USA) suggested to adopt a holistic approach focusing on the overall productivity and sustainability of the coconut-based agroecosystem as a whole, to cope with the increasing threats posed by climate change. N. M. Nayar (formerly at ICAR-CPCRI) in his keynote address, outlined the present-day impasse on policies in the coconut sector (on trade, development and research), and suggested certain remedial steps such as bringing coconut as a mandate crop of World Agroforestry Centre (WAC/ICRAF) and initiate a consortium to address the issues related to pests and diseases.

The symposium comprised of eight technical sessions. The session on 'Germplasm conservation and utilization' was chaired by N. M. Nayar and Lalith Perera (Coconut Research Institute (CRI), Sri Lanka). Achievements made through classical breeding methods in coconut were described by K. U. K. Nampoothiri (formerly at ICAR-CPCRI). He also listed the limitations and way forward on employing molecular biology tools. The talk by V. A. Parthasarathy (formerly at ICAR-Indian Institute of Spices Research) on 'Home of coconut – finding its roots through history and molecular biology' suggested that a primary or secondary origin of coconut would be South India, and cited evidence from the Tamil Sangam literature (200 BCE to 200 CE).

Alexia Prades (Coconut Genetic Resources Network (COGENT/IPGRI)), emphasized the need for evolving complementary conservation strategies for coconut as the crop is facing unprecedented genetic erosion owing to biotic and abiotic stress experienced in many countries. In his talk 'Global coconut communities – status and strategies for *in situ* diversity management and utilization', R. Bourdeix (CIRAD, France) put forward plans for coconut germplasm beyond field gene banks in farms, public gardens, university campuses, etc. This concept of networked/virtual collection could lead to the mitigation of the classical delineation between *in situ* and *ex situ* conservation in the future. Biological and socio-economic factors impacting such a conservation strategy were also discussed.

In the session, 'Biotechnology for crop improvement', Madan Kumar Bhat-tacharyya (Iowa State University, USA) outlined procedures for identification and application of non-host immunity genes in enhancing disease resistance. S. A. C. N. Perera (CRI, Sri Lanka) made a presentation on genetic relationship studies that revealed two major groups of Talls, one comprising Southeast Asia and the Pacific Talls, and the other comprising South Asia and Africa Talls.

Haeng-Hoon Kim (Sunchon National University, South Korea) reviewed plant cryopreservation methods and concluded that alternative approaches to the development of cryopreservation protocols based on the initial characteristics of plant materials are to be compared especially in the case of droplet-vitrification method. The principles and approaches of cryobanking of coconut germplasm were dealt with in the talk by Rekha Chaudhury (ICAR-NBPGR, New Delhi).

Vimala D. Nair (University of Florida, USA) described the potential role of biochar from coconut by-products as a soil amendment in the session on 'Enhancing input use efficiency'. The moisture-holding capacity of biochar from coconut by-products would be important in locations with inadequate and unpredictable rainfall, and with minimal irrigation facilities. Bioresources-based strategies

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to strengthen biological foundations of soil health and soil fertility for sustaining the productivity of coconut-based systems were discussed by George V. Thomas (KSCSTE, India). Edna A. Anit (PCAARRD-DOST, Philippines) made a presentation on coconut production systems in the Philippines.

The session on 'Management of pests and diseases' was chaired by P. Chowdappa. In the lead talk, he dealt with the threats of invasive and emerging pests and diseases of coconut. Strict quarantine laws for the movement of coconut or other ornamental palms and regular monitoring are essential for preventing the entry of these diseases and pests. P. S. P. V. Vidyasagar (formerly at King Saud University, Saudi Arabia) spoke on emerging trends in sustainable management of coconut pests with a focus on future research. He cautioned about the entry of the pest-Hispid beetle into India.

In the session on 'Climate change: Effects and mitigation', P. K. R. Nair presented the global initiatives to deal with climate change which could be grouped under two broad categories: climate-change mitigation and adaptation. These strategies involve a combination of site-specific crop management, but mostly confined to annual crops, with little attention being paid to perennials such as coconut. V. Rajagopal (formerly at ICAR-CPCRI) presented India's status paper on research on climatic risks and coconut. He summarized the results of studies on the response of coconut to moisture stress conducted at ICAR-CPCRI since 1980, which include delineation of tolerance mechanism, anatomical, physiological and biochemical markers for screening, and characterization of drought and its management. S. Naresh Kumar (ICAR-IARI) further elaborated the dynamic simulation model InfoCrop-COCONUT and its application in quantifying the spatio-temporal impacts of climate change, region-specific adaptation gains and also quantification of mitigation potential.

K. S. M. S. Raghavarao (CSIR-Central Food Technological Research Institute

(CFTRI), Mysuru) chaired the session on 'Value-addition and product diversification'. The R&D that has been carried out at CFTRI for value-added products from coconut was discussed by Raghavarao. M. Vijayakumar (Amrita Institute of Medical Sciences and Research Centre, Kochi) reviewed studies on the relationship of coconut oil and cardiovascular diseases. Coconut oil is considered as a source of saturated fat and it has been recommended to reduce its intake in order to prevent cardiovascular diseases.

In the session, 'Agribusiness and entrepreneurship', Uron N. Salum (APCC) elaborated upon the strengths and weaknesses of the global coconut sector. He suggested that the coconut farmers should replace old, senile palms with improved varieties, enhance profitability by including economically important intercrops and integrating with livestock. He concluded that the future for coconut is promising, progressive, positive and depends on value-added products like chips, sugar, virgin coconut oil, ice cream, milk, sweets, extruded products and chocolates. Strategic solutions for making the coconut industry globally competitive were presented by P. Rethinam (formerly at APCC). S. Aravazhi (ICRISAT, Hyderabad) suggested that for the growth of agribusiness, a platform must exist to enable linkages between research and business that translate into actionable initiatives which nurture innovations and develop entrepreneurship. The success story of Dinesh Food with respect to coconut value-addition was narrated by C. Rajan (Dinesh Foods, India).

The session on 'Research-extension interface and policy issues' was chaired by S. Arulraj (formerly at ICAR-IIOPR). While analysing the yield gap in coconut production in India, Arulraj remarked that crop management and policies are likely to be the primary reasons. M. Thomas Mathew (formerly at CDB) remarked that the research and development efforts have placed India as the major supplier of coconut in the world. R. Jnanadevan (CDB) talked about Co-

conut Farmers' Producer Organizations having three-tier structure consisting of Coconut Producers Society (CPS), Coconut Producers Federation (CPF) and Coconut Producers Company (CPC).

Recommendations that emerged from the technical sessions were compiled and presented in the valedictory session. The major recommendations are as follows: (i) prevail upon CGIAR to include coconut as a mandate crop under WAC/ICRAF for better coordinated research among nations; (ii) make available the mapping population developed in Côte d'Ivoire to COGENT member countries for quantitative trait loci (QTL) mapping studies; (iii) networking of international laboratories for cryogene banking of pollen and cryopreservation of zygotic embryos/plumular tissues; (iv) evaluation of economics of organic farming studies over the years and replicating successful models; (v) address biosecurity issues of coconut in the wake of climate change, globalization, free trade and increased travel across the globe – a 'global initiative on pest and disease network of coconut' is necessary involving all the coconut-growing countries and organizations like COGENT and APCC; (vi) strict implementation of domestic quarantine to prevent the spread of diseases/pests; (vii) validation of the InfoCrop-COCONUT model in other coconut-producing countries; (viii) promotion of value-added coconut products through market promotion, brand promotion and attractive and hygienic packing, and (ix) initiating policies and developmental interventions for enhancing the farmers' share in the value chain.

Encompassing these recommendations, the 'Kasaragod resolution' ([http://cpcri.gov.in/index.php/news?layout=edit\(&id=609\)](http://cpcri.gov.in/index.php/news?layout=edit(&id=609))) was adopted in the symposium.

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