Exploring coconut potential for masses

On the occasion of celebrating 100 years of coconut research, the Editor interacted with Dr P Chowdappa, Director, CPCRI, Kasaragod. The excerpts of the interaction are presented herewith topic-wise.

Plantation crops, tea, cashew, coffee, coconut, arecanut, rubber, cocoa, oil palm and spices such as cardamom, pepper etc. have a unique role in the national economy of our country. Apart from earning valuable foreign exchange, they form the backbone of the economy and lifeline in many of the southern states, by providing basic raw materials for a number of industries. Among plantation crops, coconut is a major crop grown both under plantation and homestead management system. It provides livelihood security to several millions of people across the world, and capacity of coconut in providing improved nutrition, employment and income generation are well known.

- **What is the contribution of coconut to our nation?**

  The coconut palm exerts a profound influence on the rural economy of many states where it is grown extensively and provides sustenance to more than 10 million people in the country. The processing and related activities centered on the crop generate employment opportunities for over three million people in India. In addition, it contributes ₹92,000 million annually to the GDP of the country and foreign exchange of ₹21,385 million.

- **Is the first coconut hybrid produced in India, responsible for India's top position in production and productivity?**

  Globally, out of 12.5 million hectares of area under this crop, close to nine million ha (about 75% of the total area) is contributed by only three countries, namely Indonesia, the Philippines and India. India stands first in production (23,351 million nuts), contributing 32.1% to the global production and highest productivity (11,277 nuts/ha) in the world although India has 2.13 million ha under coconut, which accounts for 16.6% of the global area. Highest production and productivity was possible because of strong research support provided by CPCRI since its beginning in 1916. The world's first coconut hybrid was produced by crossing local West Coast Tall with the Chowghat Green Dwarf at Kasaragod and the hybrids were planted at Nileshwar in 1934 for evaluation.

- **What was the driving force for taking up the cultivation and development of coconut in an organized manner in the beginning of the 20th century?**

  With the increased demand for coconut products in the European markets in the beginning of the 20th century, resulting from the expansion of the European soap and edible oil industry, and with the introduction of better road and rail connectivity and increased shipping facilities in India, the export trade in coconut products expanded considerably. This 'economic prospect' must have been the driving force for taking up the cultivation and development of coconut in an organized manner.

- **What was the catalyst for initiating concrete measures for intensifying production of coconut?**

  The world trade of copra, coconut oil and other coconut products were seriously disturbed by the outbreak of the first and second World Wars. In the early part of the 20th century, India was in a formidable position in the export trade in copra (about 30,000 tonnes of copra annually) and coconut oil, with the concomitant performance on the production front. However, the price crash in the aftermath of the first World War and the prevailing general economic crisis forced the growers to neglect the cultivation, with the cascading decline in production and the imports gaining momentum. The acute shortage experienced in India in the supply of copra and coconut oil in 1942 was the catalyst for initiating concrete measures for intensifying the production


Coconut based cropping system

of coconuts to meet the surging demands in the World War II scenario.

- **Which is the defining moment in history of CPCRI as systematic research on coconut had its beginning in the year 1916?**

The defining moment in history was in 1970, when ICAR established the Central Plantation Crops Research Institute with headquarters at Kasaragod, by merging the Central Coconut Research Stations at Kasaragod and Kayamkulam and the Central Arecanut Research Station at Vittal along with its five substations at Kannara, Mohitnagar, Kahikuchi, Hirehalli and Palode. Consequent to the establishment of the unified institute, the CCRS, Kayamkulam was made a Regional Station to work on pest and diseases of coconut, while the CARS at Vittal was also made a Regional Station of the Institute, with a mandate to carry out research on arecanut and cocoa and the Regional Arecanut Research Stations were converted as Research Centres of CPCRI.

- **Whether CPCRI has played any role in developing new institutions and nurturing them to become independent ?**

In the 1980s, CPCRI not only 'gave birth' to new institutions, but 'nurtured' them well in their infancy and 'mentored' them through adolescence to adulthood. Dedicated research institutions for individual crops or group of related crops will undoubtedly promote better R&D, with more functional autonomy, higher financial allocations, better infrastructure and human resources. The policy has paid rich dividends as can be seen from the present stature and R&D achievements of these 'sibling' institutions like the Indian Institute of Spices Research (IISR), Kozhikode; Directorate of Cashew Research, Puttur; Indian Institute of Oil Palm Research, Pedavegi and the Central Coastal Agricultural Research Institute, Goa.

- **How much genetic resources are available to tackle present and future challenges?**

The Institute has built up, over the years, a rich repository of genetic resources to provide breeders with required genetic stock to tackle present and future challenges. It is a matter of national pride that it maintains the largest collection of germplasm accessions: coconut (438), arecanut (164) and cocoa (344). International Coconut Genebank for South Asia (ICG-SA) was established under a tripartite agreement among ICAR-FAO-ITPGRFA. The Institute also hosts the National Coconut Gene Bank (NCGB) and serves as the National Active Germplasm Site (NAGS) for coconut, arecanut and cocoa. Recently, DUS (distinctiveness, uniqueness and stability) test centres for coconut, arecanut and cocoa have been started with funding from PPV&FRA, New Delhi. The Institute has facilitated development

Coconut nursery

Collection of Kalparasa

of the DUS guidelines for coconut and arecanut for effecting plant variety protection mechanism.

- **What are the breeding efforts and their impact on productivity?**

The focused breeding efforts have culminated in development and release of several high yielding varieties and hybrids ensuring higher productivity and overall profitability to the farmers. Nineteen improved high yielding varieties (thirteen selections and six hybrids) of coconut with potential for higher yield and suitable for copra/ tender nut/biotic and abiotic stress tolerance have been released for cultivation. Altogether, ten improved varieties of arecanut (eight selections and two dwarf hybrids) with higher yield and seven high yielding varieties in cocoa (three elite clones and four hybrids), with varying processing qualities have also been released. Presently, the emphasis is on developing dwarf varieties and D × T hybrids in coconut and arecanut and dual purpose varieties in coconut, in appreciation of the present day realities in this sector.

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- **To what extent Biotechnology helped in improving plantation crops, especially coconut**?

The protocol for somatic embryogenesis and plantlet regeneration in arecanut is a major breakthrough for mass multiplication of dwarf hybrids and yellow leaf disease tolerant palms. Coconut embryo culture protocol has been developed for long term storage and easy transport of germplasm during exchange. Techniques have been standardized for cryopreservation of mature coconut zygotic embryos and coconut pollen. Sequence characterized amplified regions (SCAR) markers have been developed for confirming the hybridity at seedling level in both coconut and arecanut.

- **Enhancing resource-use efficiency and income of small and marginal farmers**

It is more prudent that a traditional small-holder farmer should go for as many crops and agri-enterprises as can possibly be integrated seamlessly in to the farming system. Coconut and arecanut based inter/mixed, multi-storied multi-species cropping as well as mixed farming systems have been developed by integrating livestock for increasing total system productivity. The coconut based cropping system using multi species cropping of coconut with pepper, banana, nutmeg, pineapple, ginger, turmeric and elephant foot yam generates a net income of ₹3.7 lakhs per ha, nearly one and a half times higher than that of coconut monocrop (₹15100/ ha). A coconut based mixed farming system (CMFS) comprising coconut, pepper, banana, crossbred cows, poultry birds, goat, and pisciculture generated a net return of ₹5.5 lakhs, which is nearly three times higher than that of coconut monocrop. Arecanut based cropping system with cocoa, banana and black pepper as component crops generated net returns as high as ₹8.8 lakhs/ha, which is more than double compared to that of arecanut monocrop (₹3.80 lakhs). Arecanut based mixed farming system (AMFS) with dairying, fresh water aquaculture and fodder grass (Hybrid Napier) components generated net returns up to ₹6.6 lakhs/ha, which

Machinaries in the Agro Processing Centre

is quite higher than that of arecanut monocrop.

- **Is it possible to enrich soil health through utilization of organic wastes available in the coconut gardens?**
  A versatile technology has been developed to utilize crop wastes (a coconut garden of one hectare area can generate up to eight tonnes of leaf biomass residues every year) for production of mushrooms and vermicompost using the local isolate of *Eudrilus eugeniae* of earthworm, meeting 50% of the nitrogen requirement of coconut palms. Similarly, arecanut and cocoa gardens generate biomass of 12 and 8.5 tonnes/ha respectively and these wastes could be effectively utilized for production of vermicompost, oyster mushroom and as livestock feed, meeting the nitrogen and phosphorus requirements of these crops considerably, with consequential savings in the cost of cultivation and additional income from value added products. On farm coir pith composting technology has been developed to produce organic inputs to the plantation as well as soilless medium for crops. Two plant growth promoting rhizobacteria (PGPR) based products (Kera Probio and Cocoa Probio) have been launched recently for promoting clean and green, sustainable cultivation of coconut.
- **Per drop, more crop– possible in coconut?**
  In situ soil and water conservation techniques helps in augmenting the soil moisture availability in coconut plantations having mild slope and could enhance coconut yield up to 60%, besides reducing soil erosion and consequential nutrient loss. Drip irrigation in arecanut, coconut and cocoa has reduced the use of water to the extent of 35-40% with increase in yield by 30-40%. Drip fertigation in these crops has reduced the use of chemical fertilizer from 50 to 75% with increase in yield by 35-40%.
- **Since coconut is perennial crop, what are the strategies required to manage pest and diseases?**
  Strategies are developed for management of major pest and diseases of coconut. Area wide community extension approach and participatory technology transfer approach were successfully implemented by CPCRI for management of major coconut pests, rhinoceros beetle, black headed caterpillar, red palm weevil and eriophyid mites and diseases like the root (wilt) disease, stem bleeding, leaf blight and bud rot. This kind of approach is very much required for perennial crop like coconut rather than stand alone farmer approach.
- **In the context of high labour wages and their non-availability for timely farm operations, what remedial measurhas CPCRI did take?**
  Mechanization of farm operations is the immediate requirement of the farmers to reduce the cost of production and increase the labour efficiency, especially in the context of high labour wages and their non-availability for timely farm operations. The safety attachment incorporated by CPCRI to the popular model of climbing device has become an effective solution since it could be operated even by women with proper training. Apart from this, manual and power operated coconut husking machines, coconut shell splitting device, de-shelling machine, tender coconut punch and cutter, coconut dryers of varying capacities and using different fuel sources, testa remover, coconut slicing machine, coconut milk expeller, VCO cooker, VCO fermentation tank, copra moisture meter and telescopic sprayers are the other major contributions from the institute.
- **What are the health benefits of coconut?**
  The nutritional, nutraceutical and health benefits of tender coconut, coconut oil and virgin coconut oil have been elucidated in our efforts to promote coconut as a health-wellness-food crop. Coconut is an excellent source of good fats with medium chain triglycerides and the consumption/topical application of coconut oil is traditionally believed to impart physical, mental and curative

Extruded products from coconut meal

Leguminous cover crop

health benefits. Tender coconut water is a rich source of essential electrolytes like sodium, potassium, magnesium, calcium and phosphorus. It is also rich in tocopherol, polyphenol and anti-oxidant activity, qualifying it as a pure natural nutritious health drink, truly a nature's bounty. The presence of lauric acids, polyphenols and anti-oxidants in virgin coconut oil finds a place in cosmetic and overall health care products.

- **Can value-addition ensure fair, reasonable and steady price to coconut farmers?**

Value added products can thereby become a deciding factor in the price movement of coconut to ensure fair, reasonable and steady price to coconut farmers. There exists a huge scope for coconut based agri-business in India in order to increase the present 8% level of value addition to 25%. In an effort towards value addition, Institute has developed complete 'technology packages' for production of virgin coconut oil, coconut chips, coconut honey, jaggery, sugar, ice creams, extruded products and sugar based chocolates and drinking chocolates and sweets. CPCRI has developed 'Coco-sap Chiller' for collecting fresh, hygienic and unfermented coconut inflorescence sap called Kalparasa. A bottling technology has been developed for Kalparasa,which can extend its shelf-life up to 45 days under refrigerated condition without adding any preservatives and additives. It has been demonstrated that a farmer tapping 15 coconut palms for Kalparasa could earn, on an average, net profit of ₹45,000 a month, while a tapper can earn about ₹20,000/month.

Kalparasa

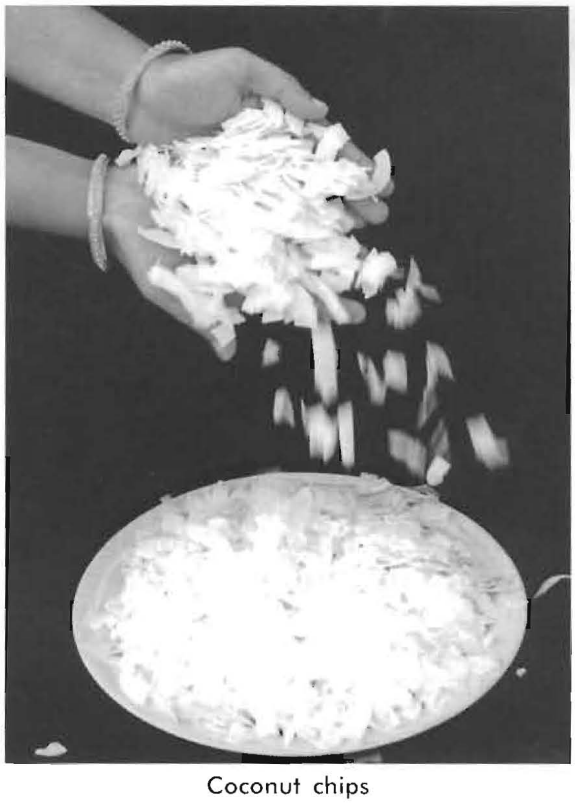
- **What the mechanisms CPCRI adopting for dissemination of technologies to stakeholders?**

Dissemination of technologies are pursued through on-campus and off-campus training programmes, frontline demonstrations, INM, IPM, IDM and post-harvest technologies, exposure visit of clientele, diagnostic field visits, *Kisan Melas*, exhibitions, mass communication media and print media. Research-extension-farmer

interface are facilitated through interactive video conferencing. An e-kalpa mobile based application has been launched for effective interaction with farmers. We interact with farmers in social media and groups like Watsapp arecanut growers, kalpa, e-horticulture, MH agrisolutions etc.

- **What is the economic impact of CPCRI technologies ?**

The consistent research efforts of the institute have greatly contributed towards the overall growth in area, production and productivity of the mandate crops. It is estimated that, in terms of Gross Value Output, coconut contributes ₹95,000 million to the national income and arecanut contributes ₹45,000 million and cocoa, ₹2,000 million. In terms of exports, coconut earns ₹21,385 million (including coir products) while the contribution of arecanut is ₹300 million. Last two years, CPCRI has licensed its technologies like production of kalparasa, coconut sugar, virgin coconut oil, coconut chips and machineries to 160 stakeholders. The overall economic impact (per annum) due to the adoption of CPCRI technologies has been estimated to be ₹19,000 million.



Coconut chips

- **What would be the demand and supply scenario for 2050?**

Assuming the projected population of India by the year 2050 as 1.62 billion, the projected coconut demand for 2050 is predicted to be about 45,000 million nuts. With the projected supply of around 36,000 million nuts, there would be a demand-supply gap of 8,695 million nuts by 2050. In order to meet the projected demand, the annual growth rate in production should be 3.20%.

- **Explain export-import scenario?**

During 2012-13, export of coconut products (excluding coir items) was valued at ₹102,236 lakh as against ₹94,329 lakh. This shows an increase in export by 26% in terms of value. Government of India has notified Coconut Development Board as an Export Promotion Council (EPC) for all coconut products other than those made from coconut husk and fibre.

- **What are the challenges being faced by the coconut sector?**

The dwindling agricultural land/water and other natural resources and skilled labourers. Impending global warming and related climate change might lead to prolonged drought, emergence of new pests and diseases and fluctuating market prices can affect over all profitability. As on today, the production cost for coconut is around ₹9.00/nut but market price ranges from ₹3-5/nut and farmer is losing heavily. The coconut based cropping system provided much relief and ensured the farmers profitability even though farmer is losing from coconut.

- **What are strategies contemplated to address the challenges?**

There are valuable strategies. They are enhancing yields using sustainable agricultural practices, access to quality, disease-free planting materials and the right inputs, judicial utilization of natural resources, value-addition and effective market access and effectively addressing the developmental and policy issues.

- **Define innovation system of coconut sector.**

The innovation system for coconuts in India is unique wherein several governmental agencies/ institutes undertake the research and development for the commodity, with evidently lacking collaborative efforts. Six components identified in the innovation system of coconut were: (i) CPCRI is spearheading technology generation for coconut production. The SAUs are also working in coordination under the AICRP on Palms for location-specific technology generation in coconut (ii) At the policy level, Coconut Development Board (CDB) is the key organization, which is a statutory body under the Government of India for the integrated development of coconut production and utilization in the country (iii) For marketing aspects of coconuts, National Agricultural Cooperative Marketing Federation of India Ltd (NAFED), established in 1958, has been entrusted to procure the copra from market at the minimum support price (MSP) in the event of market price crash. (iv) The unorganized producers with small and marginal holdings constitute the fourth component of the coconut innovation system (v) The intermediaries in the coconut sector operate in a very large grey area forming syndicates, lobbies and also practice the copra/coconut oil hoarding which causes continuous price fluctuations in the market (vi) The consumers of coconut and coconut products, these include a large number of households as well as industrial consumers.

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