

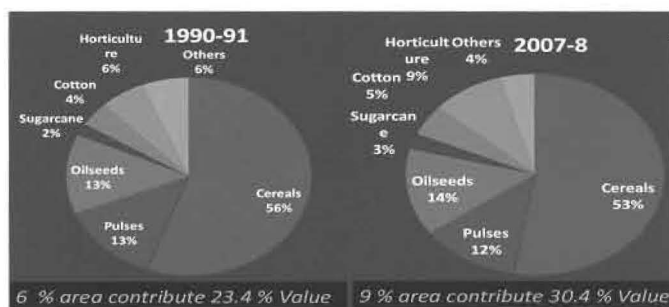
# Status of Coconut Research and Development in India

H.P. Singh

Endowed with diverse agro-climatic conditions, the country has opportunity for growing wide range of horticultural crops, such as, fruits, vegetables root and tuber crops, mushroom, ornamental crops, medicinal and aromatic plants, spices and plantation crops like coconut, arecanut, cashew and cocoa. The annual production of horticultural produce which has touched 240 million tonnes from an estimated area of 22 million hectares contributes more than 30.5 per cent to GDP of agriculture, from less than 10 per cent of cropped area. This has been possible through technological interventions coupled with mission mode approach, and this trend of

development is now referred as “Golden Revolution”. Consequently, India has emerged as the second largest producer of fruits and vegetables in the world and the country is also a leading producer of plantation crops with

contribution of 22.34% in coconut, 25% in cashewnut and 55% in arecanut to the global production.



Contribution of horticulture in India

Horticultural crops play a unique role in India's economy by improving the income of the rural people, ensuring livelihood and

nutritional security. Cultivation of these crops is labour intensive and generates employment opportunities for the rural community. Among the horticulture crops, coconut palm is the major one grown both under plantation and homestead management system.

Deputy Director General (Hort.) ICAR  
& Former Chairman, CDB, GOI

## The Coconut palm

The coconut palm occupies an area of about 1.94 million hectares in the country, with an estimated annual production of 15,730 million nuts and per hectare productivity of 8,303 nuts. It provides nutritious food and a refreshing drink and oil for edible and non-edible uses, fibre of commercial value, shell for fuel and industrial uses, thatch, alcoholic beverage, timber and a variety of miscellaneous products for use as domestic fuel. Owing to multifaceted uses of coconut, it is often referred as "Tree of Life" and is a cultural heritage embedded in the socio economic fabric of coconut growing countries.

The coconut palm exerts a profound influence on the rural economy of the states where it is grown extensively and it provides sustenance to more than 10 million people. The export earnings derived by India from coconut are around Rs.13,370 million, mainly

through the export of coir and coir products. The processing and related activities centered around the crop generate employment opportunities for over two million people in India. In addition, the crop contributes Rs.83,000 million annually to the Gross Domestic Product (GDP) of the country. As an oil seed, coconut holds 15.2 per cent share of the total oilseed value output in the country. As far as regional economy is concerned, coconut sector contributes around 21 percent of total agricultural GDP of Kerala, thus inextricably linked to the agricultural economy of the state.

## Trends in the coconut production and prices

Coconut production in India is spread over a dozen states and the coconut producing states could be classified as major producers and minor producers. The group of

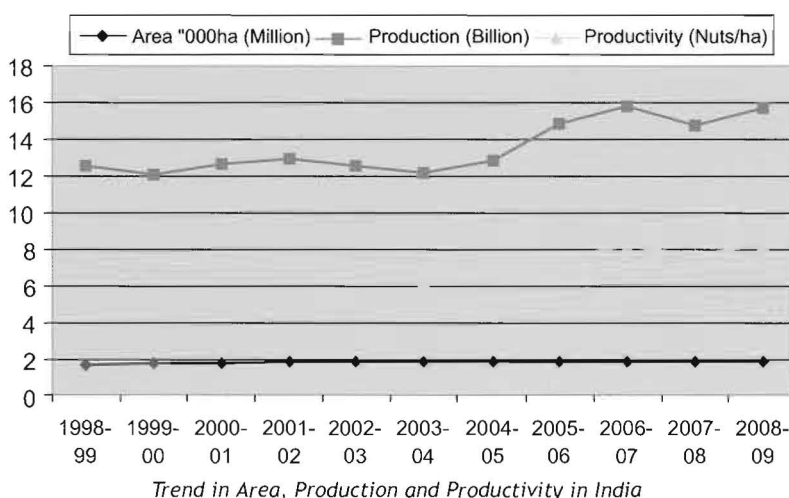
major producers has remained with just four States, namely the South Indian states of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala. Kerala is the leading coconut producer in the country with an annual production of 5,803 million nuts, followed by Tamil Nadu with 5,365 million nuts. The minor producer group has many states but their aggregate share in the total production has remained well below 10 percent over the last 40 years.

Coconut production in the country has increased from 12,678 million nuts in the year 2001 to 15,730 million nuts in 2009 with 3.5 percent compound growth rate. Productivity also has shown an upward trend from 6,952

nuts per hectare in 2001 to 8,303 nuts in 2009. Among the major producers of coconut, the trends in area and production are diverse. The overall share of the four south Indian states in total area and production has remained around 90 percent through out the period and the

major producing state among the four, namely Kerala has steadily lost its share in area and production of the crop.

Fragmented holdings, scattered production, the homestead nature of cultivation, incidence of pests and diseases and the large stock of senile palms are the major constraints in coconut cultivation. Lack of adoption of scientific cultivation practices including balanced nutrient management is one of the reasons for declining productivity trends in some regions of the country. Coconut palm is infested by a number of pests and diseases. Some are lethal in nature while others reduce the production potential of the palm. Root (wilt) disease has adversely affected coconut production in Kerala and parts of the neighbouring states of Tamil Nadu and Karnataka. Apart from this, the bud rot disease, pests like eriophyid mite, red palm weevil



and rhinoceros beetle also have adverse effect on production of coconut. A general decline in consumption demand for coconut oil has been observed especially in the household edible sector in different states. The uneconomic price trends prevailed over a long period of time has literally curbed the interest of coconut farmers and many of them have started neglecting their coconut gardens. Escalating labour cost has further eroded the profitability of coconut farming and consequently the farmers have lost interest in the proper maintenance of gardens. This has resulted in a slow but steady decline in productivity in states like Kerala.

### Prospects and challenges in the Indian coconut sector

Coconut has been traditionally considered as an oil seed crop and the farm gate price as received by the farmers is determined by the ruling prices of vegetable oils prevailing in the region. However, in the recent years, the contribution of coconut towards the vegetable oil requirements in India has shown a declining trend as a result of reduction in the percentage of coconut utilized for extraction of oil. The output of coconut oil failed to keep pace with the steady increase in the per capita consumption of vegetable oils in the country.

Profitability of coconut farming for oil production has been steadily declining over the years primarily due to the lower unit output of oil as compared to that of other oil producing crops. Therefore, coconut cannot be competitive with other sources of oil considering its high cost of production. Coconut oil, therefore, needs promotion as high value oil due to its nutraceutical properties.

However, being a multiproduct crop, coconut is able to provide multiple products that could make the crop economically remunerative resulting in better realization of income by the farmers. Hence, in the recent years, instead of projecting coconut palm as an oil yielding crop, efforts have been made to increase the use of coconut for the production of many high value products. Valuable products like tender coconut water, virgin coconut oil etc. are being promoted as the major products of health value

and these could form the sources of better income to the coconut sector in future.

Although technology led development has been achieved over several decades in coconut sector, the loss in production coupled with negative trends in price levels created a crisis of unprecedented proportion to the coconut economy and to the farmers largely depending on it for their livelihood. The human dimensions of the crisis in Kerala State, for example, are that the discouraging trends have directly affected the livelihood of nearly one million farm households, representing almost 20 percent of total farm holdings of the State and indirectly another 0.2 million households, who solely depend on the processing of coir, a by product of coconut, for their livelihoods. Majority of the coconut farmers affected are of small and marginal category, owning less than one hectare of coconut garden. As of now, India has the distinction of consuming almost all its domestic coconut production. The major challenge now is to create adequate surplus production, so that India could enter into the competitive export market for coconut products. There is urgent need for an extensive rejuvenation programme in the coconut farming sector through which the existing old and senile palms could be replaced with high yielders. A paradigm shift in placing the coconut from an oil seed crop to a multi products crop is also important and, this can be made possible by diversifying and popularizing the value added products from coconut among the consumers. Enhancing farm level income through productivity improvement and appropriate farming systems, product diversification and concurrent demand creation for the new products are the needs of the hour.

### Research support for coconut

Research is the basic requirement for improvement in production and productivity of any crops. Coconut is backed by a strong research system in the form of a Central Institute, the Central Plantation Crops Research Institute (CPCRI) with its network of regional stations and research centres and the 12 Coordinating Centers of the AICRP on Palms under the Indian Council of Agricultural Research (ICAR). The vision of ICAR under the Ministry of Agriculture, Government of India, is to make India a world leader in

the production and productivity of coconut. To this end, efforts have been made to harness science and technology to enhance competitiveness in coconut through generation of appropriate technologies. In line with this the major objectives of the coconut research programme at CPCRI is as follows:

- Strengthening the biodiversity and bio-security of mandate crops and their utilization for improving the productivity and income security of coconut growers
- Protecting and improving the land, water, microbial and climate resources essential for sustained advances in the productivity, profitability and stability of palm based farming systems
- Development of appropriate technologies which can help to attract entrepreneurs and can confer the empowerment of small and marginal farmers both in the production and post-harvest technologies, thereby enhancing their income and competitiveness
- Promote adaptation and mitigation strategies for climate change and to evolve mechanisms for crop and water management

- Enhancing the income, livelihood, nutrition and health security of farm families through mutually reinforcing package of technologies
- Promote innovations and improve human resource capacity involving all stakeholders in plantation crops
- Foster linkages and collaborations with public and private, national and international organizations.

The AICRP on Palms enables development of location specific varieties and appropriate crop production technologies for the different agro-climatic zones in the country. The institute and AICRP centres have been strengthened from time to time and now CPCRI is a model institute for coconut research. The research efforts have resulted in conservation of world coconut germplasm, development of 34 improved varieties, including 15 hybrid combinations, technology for embryo culture and cryopreservation, coconut - based farming and cropping system models, and development of value addition technologies including farm mechanization.

*Central Plantation Crops Research Institute*



Research efforts in the past decades yielded fruitful results in terms of increasing the production and productivity through high yielding varieties, developing farming system models for increased profitability in different agro climatic zones of the country, technologies for management of major pests and diseases, developing of processing technologies for value addition and farm mechanization for production and processing. There are possibilities of increasing the productivity and net returns from coconut gardens by raising compatible subsidiary crops and integrating the system with live stock. The farming system models of CPCRI have conclusively proved that the scientifically designed coconut-based farming system is not only capable of generating higher income, but also employment potential of small-holdings. In a scientifically laid out coconut based farming system, unlike the traditional ones, the resource use efficiency gets considerably enhanced from crop-livestock interactions in the system.

CPCRI has developed many practical models of coconut based intensive integrated farming systems involving compatible combinations of trees, shrubs and arable crops with or without livestock components. Coconut based inter/mixed, multi storied multi-species cropping systems developed at CPCRI are being widely adopted by the farmers. The vermicomposting technique, using indigenous earthworm, *Eudrilus* sp, developed by the institute for compositing coconut farm wastes has received national recognition and is being widely adopted by farmers across the country. The Institute has also evolved integrated



*Coconut high density multispecies cropping system*

pest and disease management strategies for all the major and minor pests and diseases in the mandate crops. Sustained efforts are being made to refine IPM package for major pests of coconut.

ELISA for the detection of root (wilt) disease using polyclonal antibodies has been refined further to a simple and very rapid test. The phytoplasma associated with the root (wilt) disease was characterized as belonging to 16S rDNA XIV group and is related to sugarcane white leaf phytoplasma, Bermuda grass white leaf phytoplasma and the coconut Weligama wilt of Sri Lanka with >95 % similarity. Hot spot survey and identification of disease escapes and



*Vermicomposting using Eudrilus sp*



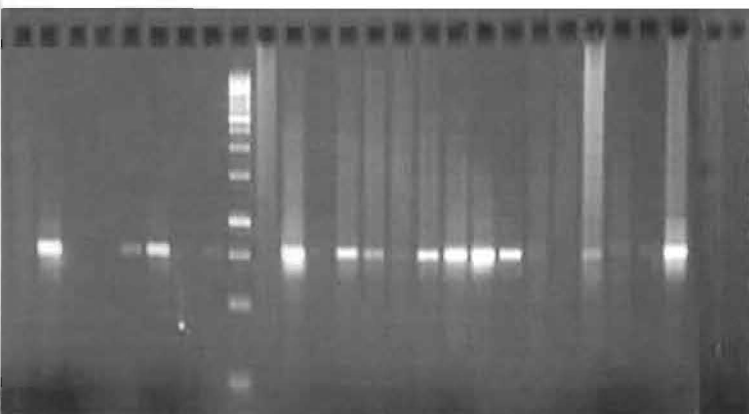
*Kalpa Pratibha - a high yielding variety*



*Kalparaksha- variety for root (wilt) tracts*

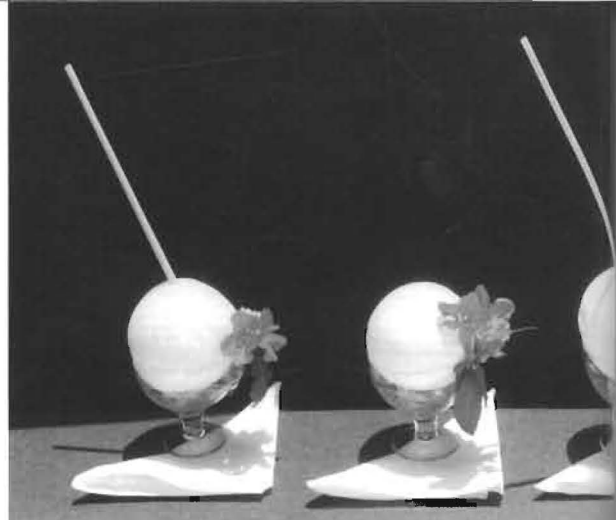
breeding programme using them resulted in the development of disease tolerant hybrids. For management of root (wilt) affected gardens, an integrated management strategy involving nutrient management through application of organic manures along with chemical fertilizers, cover cropping in the basin etc., along with adopting mixed cropping and mixed farming enterprises is recommended.

Work on farm mechanization and post harvest processing has also received adequate attention at the institute. Copra dryers, coconut splitting device, copra moisture meter, tender nut punch and cutter and coconut deshelling machine, manual/power operated coconut/arecanut sprayer, coconut grating machine etc. are some of the gadgets developed by the Institute. Coconut chips slicing machine and a simple coconut and arecanut palm climbing device are the latest additions to the repertoire of agricultural implements and gadgets developed by the Institute. Technologies for making value added products like snowball tender nut and coconut chips have been developed at the institute and are being promoted vigorously among prospective entrepreneurs. Technology/ know-how for production of virgin coconut oil by fermentation and by hot processing has been standardized and the same is being transferred to entrepreneurs, self help groups and NGOs.



*Molecular detection of Coconut root (wilt) phytoplasma*

Over the years, strenuous efforts have been made adequately promote the mandate crops of the Institute through effective extension activities including training farmer participatory approaches in technology



*Snowball tender coconut*

development and dissemination, participation in exhibitions and conducting Kisan Melas, and production and distribution of planting materials of mandate crops. The two Krishi Vigyan Kendras under the Institute (at Kasaragod and Kayamkulam) have been on the forefront of helping the farming community in the respective districts. Besides, Agricultural Technology Information Centre (ATIC) operational at CPCRI, Kasaragod serves as single window access for the farmers.

## Perspectives for coconut research and development

In the evolving trade liberalization regime, sustaining coconut cultivation as a profitable enterprise is extremely



*Coconut chips*

challenging. Hence the policies should focus more on competitiveness through higher productivity. The present discouraging trend in coconut sector also requires technology interventions as well as integrated farming approaches with emphasis on multi-tier cropping systems to improve productivity as well as profitability for growers. The strategy for coconut development must be multifaceted and people-centred with farm-households forming the target group. The primary objectives of such a strategy could be

- To create opportunities for enhanced on-farm income and employment
- To promote efficient product and by product utilization both at the on-farm and community levels
- Utilize frontier science of genomics, bioinformatics
- To strengthen marketing infrastructure for domestic and export marketing
- To direct research on varietal improvement for higher output of primary products from coconut and technology development.
- To promote organic farming in coconut
- To develop Decision Support System for coconut stress management and to deliver farmer friendly portal
- To develop location specific need based application of resources to increase the nutrient use efficiency and increased productivity through precision farming initiatives
- To utilize the emerging field of nanotechnology in disease diagnostics, smart delivery of nutrients, pesticides, bio-processing and post harvest technology. Nano particle approach will surely pave the way for sensitive diagnosis of coconut root (wilt) disease. Nano particles could be effectively used for the effective release of pesticides and pheromones. Smart packaging with nanotechnology approach for the coconut products such as tender coconut water, coconut meat and inflorescence sap could increase their shelf life.

- To create consumer demands among health conscious population for coconut/coconut products to further promote and sustain coconut as the Tree of Life.

Considering the importance of coconut in providing livelihood as well as nutritional security in the global scenario, the country hosted an International Conference on Coconut Biodiversity for Prosperity at the Central Plantation Crops Research Institute, Kerala, during 25-28 October 2010. The conference took stock of the global developments in the field of coconut research and development and adopted a resolution which is reproduced below.

#### **“KASARAGOD DECLARATION - OCTOBER 2010**

##### ***Coconut as food for nutrition, health care and environmental services - global initiative and perspective***

*Coconut, “Tree of life” with multifaceted uses, interwoven in cultural heritage and socio economics of the many countries across the globe, especially in Asia and the Pacific region, has provided livelihood to millions of people. Coconut as vegetable oil, which ruled the trade for centuries is becoming uncompetitive due to competition from other vegetable oils, especially palm oil resulting in reduced profitability to the coconut farmers. Efforts have succeeded in demonstrating the health benefits and its capacity to provide required nutrition and health care coupled with diversified products. Yet, it is not competitive enough to provide the required income to farmers to sustain the livelihood. Looking at various aspects of coconut, in the International Conference on “Coconut Biodiversity for Prosperity,” through deliberations and discussions, organized at Central Plantation Crops Research Institute, Kasaragod, in October 2010, it became evident that coconut crop requires to be promoted as a food for nutrition, health care and environmental services to safeguard the interest of millions of people and their livelihood. Thus, International Conference unanimously supports sharing of knowledge across the globe through collaborative efforts to address the common problems and also new frontier of science*

*and technology, which would include understanding of structural and functional genomics, long term conservation of genetic resources through cryopreservation, health benefit of coconut, problems of diseases of coconut like wilt and its management, environmental benefits through sequestration of carbon, as net carbon sinks and its benefit, for sustainable use of coconut to provide quality of life to the people. Therefore, the conference declares that the coconut must be promoted as food for nutrition, health care and environmental services to support the farming community and also the consumers. The conference also declares that there should be global initiatives for sustainability of coconut through understanding of structural and functional genomics, long term conservation through cryopreservation of genetic resources, unfolding of more nutritional and health benefits and also understanding of coconut wilt and its management. We pledge to work together for sustainability of the coconut to serve the mankind, who depend on coconut for livelihood and quality of life.*

*Declaration adopted on 28<sup>th</sup>, October, 2010 by delegates representing 11 countries.*

**Central Plantation Crops Research Institute,  
Kasaragod 671 124, Kerala, India  
25-28 October, 2010"**

## Conclusion

Apparently, there is a need for bold initiatives that would transcend conventional boundaries of science and geographical delimitations for bringing about unprecedented success. Global initiatives are required for tackling long-standing and complex problems like phytoplasmal diseases of coconut and arecanut. Efforts have been made to understand the gene function but they have been done as small initiatives and in isolated manner and have not been sufficient to provide adequate lead for solving the complex problems plaguing coconut production. There is an urgent need to take up a research initiative on "genomics of coconut" in a "consortia mode" for speedier results. The information generated through this initiative could be of immense value for addressing the many issues plaguing coconut including challenges from biotic and abiotic stress. Path-breaking efforts are warranted to overcome the current system which prompts farmers to opt for more remunerative cash crops like rubber, especially in traditional coconut growing areas in Kerala. This would overcome the stagnation especially in crop coverage and transform coconut sector into a vibrant, competitive and profit-making sector. Hopefully, our research efforts will be able to unleash such crucial initiatives to sustain the "Tree of Life" for the benefit of mankind.

