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From the desk of Chairman

Dear Coconut farmers,

Coconut is a perennial crop with a long life span which needs abundant number of nutrients for a sustainable growth and yield. Application of organic manure is a very essential component in coconut nutrition for maintaining the soil health. Organic fertilization is considered a versatile component in a coconut based farming system. Regular application of organic manure is important as it contains several nutrients required for coconut though in lower concentration than inorganic fertilizers. The nutrients present in organic manures remain in the soil for a longer period and the palms get continuous supply of these nutrients. Organic matter provides microbial process in the soil, improves soil structure, aeration and water holding capacity of the soil. It also has a regulatory effect on soil temperature, delays the fixation of minerals and supplies decomposed products which enhance the supply of nutrients to the palm which in turn helps the growth and yield of coconut palm. It is a slow source of uniformly active nitrogen and consequently influences the protein content of plants.

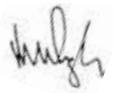
Organic manure includes both bulky and concentrated manures. Farm yard manure, compost and green manures are bulky organic manures whereas oil cake, fish meal etc are concentrated organic manures. Application of 20-25 kg of any bulky organic manure supplemented with the recommended quantity of inorganic fertilizers based on soil test results in the best manurial combination for an adult bearing palm. For the management of major coconut diseases, application of up to 50 kg organic manure per palm is recommended for improving the plant health. Green manure crops such as Cowpea, Pueraria, Calapagonium, Mimosa etc could be grown in the basin/ inter spaces of coconut. By growing such crops at the rate of 100 gm seed per palm basin, 25 kg to 50 kg green manures can be obtained for the palm.

In order to promote the use of optimum manures and fertilizers, the Ministry of Agriculture and Farmers Welfare is implementing a scheme through the concerned State Governments, 'soil heath card' for testing the soil and applying fertilizers and manures based on soil test result. CDB is also promoting the use of organic manures in coconut gardens. Regular application of organic manure along with inorganic fertilizers is one of the major recommendations under the productivity improvement programme of the Board. A scheme for providing financial assistance for establishing organic manure units by utilizing the farm waste available in coconut gardens is also being implemented by the Board under MIDH through State Department of Agriculture / Horticulture and also directly by the Board through the Farmer Producer Organizations in coconut sector. Financial assistance @ Rs.60, 000 per unit of size 1200 cubic feet is extended to the farmers under the scheme for establishing vermi compost/ coir pith compost production unit.

I request the coconut farmers to avail the assistance extended under the scheme and improve the health of soil and thereby increase the production and productivity of coconut in our country.

With warm regards,

A K Singh



Chairman

Coconut development in India - The status

A.K. Singh
Chairman, Coconut Development Board, Kochi-11

Introduction

Coconut is an important crop of economic importance to many of the Asian and Pacific countries in the world. The crop provides livelihood security and employment opportunities to a major segments of the rural mass of these countries. India being the largest coconut producing country in the world occupies 31% of global production. Widely acclaimed as Kalpavriksha or Tree of life, the coconut palm provides food security and livelihood opportunities to more than 10 million people in India. It is an important food crop for the major chunk of Indian population. Similarly it is an important cash crop for more than 10 million farm families and a fiber-yielding crop for more than 15,000 coir based industries which provides employment to nearly 6 lakhs workers of which 80 per cent are women folk. The crop contributes around Rs. 1,00,000 million (US$ 1530 M) to the country's GDP and earns export revenue of around Rs. 30,000 million (US$ 458 M). Coconut and coconut products are gaining global importance as a contributing factor to the health, nutrition and wellness of human beings. This is due to its multiple medicinal and nutraceutical properties being revealed day by day. This new development in health sector brought in unprecedented increase in demand of coconut products in domestic and international markets. It is estimated that there are 5 million coconut holdings and 12 million farmers in the country covering 17 states and 3 Union Territories. This country paper encompasses the major developments in Indian coconut sector along with other salient outcomes.

Indian Coconut Scenario

Area, Production and Productivity

As per the India estimates for the year 2014-15, the area and production of coconut in the country is 1.98 million hectares and 20439.61 million nuts respectively. The corresponding figures for the year 2013-14 were 2.14 million hectares and 21665.19 million nuts, recording decrease in area by 7.69 percent and production by 5.66 percent. The four southern states of Kerala, Karnataka, Tamil Nadu and Andhra Pradesh accounted for 87.86 percent of the coconut area and 90.11 percent of the coconut production in the country.

The productivity of coconut at national level for 2014-15 is 10345 nuts per hectare which showed an increase by 223 nuts over the previous year. The highest yield is reported from Lakshadweep Islands at 27591 nuts per hectare followed by Chhattisgarh at 16287 nuts per hectare and Telengana 14994 nuts per ha. Tamil Nadu is having highest the yield among the major coconut growing states with 14873 nuts followed by Andhra Pradesh with 13808 nuts.

As per 2014 world statistics, India is the largest coconut producing country in the world contributing 31.02% of the world production. World Production has decreased from 70931.79 million nuts in 2013 to 69836.36 million nuts in 2013. India, Indonesia and

Table 1

Area, Production and Productivity of Coconut in India 2014-15

	States	Area "000" ha	% Share in Area	Production Million nuts	% Share in Production	Yield (Nuts /Ha)
1	Kerala	649.85	32.89%	4896.61	23.96%	7535
2	Karnataka	515.03	26.07%	5141.15	25.15%	9982
3	Tamil Nadu	465.11	23.54%	6917.46	33.84%	14873
4	Andhra Pradesh	105.99	5.36%	1463.56	7.16%	13808
5	Odisha	50.68	2.57%	324.89	1.59%	6411
6	Gujarat	31.63	1.60%	295.03	1.44%	9328
7	West Bengal	29.41	1.49%	372.23	1.82%	12657
8	Maharashtra	28.10	1.42%	187.44	0.92%	6670
9	Goa	25.79	1.31%	127.72	0.62%	4952
10	Andaman Nicobar	21.91	1.11%	129.77	0.63%	5923
11	Assam	21.14	1.07%	237.49	1.16%	11234
12	Bihar	14.90	0.75%	141.38	0.69%	9489
13	Tripura	6.93	0.35%	28.41	0.14%	4100
14	Lakshad-weep	2.57	0.13%	70.91	0.35%	27591
15	Puducherry	1.88	0.10%	21.90	0.11%	11649
16	Chhattisgarh	1.71	0.09%	27.85	0.14%	16287
17	Telengana	1.69	0.09%	25.34	0.12%	14994
18	Nagaland	1.45	0.07%	16.32	0.08%	11255
19	Mizoram	0.04	0.00%	0.16	0.00%	4000
20	Daman & Diu	Neg		13.99	0.07%	
		1975.81	100.00%	20439.60	100.00%	10345

Source : Horticulture Division ,Government of India

Philippines are the leading coconut growing countries having 75.87% of the total coconut area and contribute 75.48% of the coconut production in the world. Among the major coconut growing countries, Brazil holds the highest productivity of 11630 nuts per ha followed by India with 10119 nuts per ha. Area, production statistics of India and world is given in Table 1 and 2.

Price Scenario

The price of coconut and coconut products was on the declining trend during the last one year. The price which was steadily in an upward trend from the middle of 2013-14 exhibited a very encouraging trend through out 2014-15; but it was on reverse move in 2015-16. Average domestic price and international price of coconut oil per Metric Tonne was US $ 2407 and US $ 1225 in 2014-15. This has come down to US $ 1701 and US $ 1121 respectively in 2015-16.

The domestic price of coconut products in India was always ruling higher compared to international price. During many occasions domestic price was 100 % higher than the international price. But after a long spell, the gap between international and domestic price started narrowing down and in March, 2016 the international price became higher than that of domestic price which presents immense opportunity for India for exporting coconut products.

Export of Coconut Products

During the financial year 2015-16 export of coconut products (excluding coir items) was valued at Rs. 14502.84 Million (US$ 221.07 M) against Rs. 13123.85 Million (US$ 214.20 M) during the previous year, recording an increase of 10.50 % in terms of value. Activated Carbon was the single largest item of export both in terms of quantity and value of export, at 61212.58 tonnes and Rs. 6320.81 Million (US$.96.35M) respectively. Significant increase was recorded in the export of desiccated coconut, activated carbon and coconut oil. Activated carbon accounted for 43.58 percent of total export value. Over the last 5 years value of export of coconut products showed an increasing trend from Rs. 8386.47 Million (US$ 174.60 M) in 2011-12, to Rs. 14502.84 Million(US$.221.07 million) in 2015-16.

The export earnings are picking up with the surge in growth of industries based on virgin coconut oil, activated carbon, shell charcoal etc. Indian products are moving to US, UK, Germany, Japan, France, Middle East, and African Countries. Advancement in technology development and the technical and financial support extended by India through the Coconut Development Board under the Technology Mission programme for starting coconut based industries have been instrumental for this success. Added to these the Board has been designated as Export Promotion Council (EPC) for various products other than coir based products from 1st April 2009 which also has contributed to a perceptible improvement in export which is depicted in Table 3:

Table - 2

Coconut Scenario - Global

Area, Production and Productivity in Major Coconut Growing Countries (2014)

Sl. No.	Country	Area ('000 ha)	% Share in Area	Production (Million Nuts)	% Share in Production	Productivity (Nuts/ha)
1	India	2141.00	17.55%	21665.00	31.02%	10119
2	Indonesia	3610.00	29.60%	16354.00	23.42%	4530
3	Philippines	3502.00	28.71%	14696.00	21.04%	4196
4	Brazil	251.00	2.06%	2919.11	4.18%	11630
5	Srilanka	440.00	3.61%	2870.00	4.11%	6523
6	Papua New Guinea	221.00	1.81%	1483.00	2.12%	6710
7	Vietnam	159.00	1.30%	1245.59	1.78%	7834
8	Mexicor	169.00	1.39%	1118.75	1.60%	6620
9	Thailand	206.00	1.69%	1001.00	1.43%	4859
10	Tanzania	128.00	1.05%	545.80	0.78%	4264
	Others	1369.00	11.22%	5938.12	8.50%	4338
	Total	12196.00	100.00%	69836.36	100.00%	5726

r - Revised

Source: APCC Statistical Year Book - 2014

Table - 3

Year	Export value	
	(In INR Million)	(In USD Million)
2009-10	4323.84	91.71
2010-11	5256.50	115.61
2011-12	8386.47	174.60
2012-13	10225.33	187.92
2013-14	11561.19	190.24
2014-15	13123.85	214.20
2015-16	14502.44	221.07

In the capacity of EPC Board has so far given registration to 2346 exporters under its fold. This has enabled the Board to monitor the export scenario closely which is an indication of country's growth in the sector.

Strength of Indian Coconut Sector

India being the largest producer of coconut in the world having sufficient raw material surplus, good reputation in global markets, access to good technologies (virgin coconut oil, packed tender nut water, minimally processed tender coconuts, activated carbon) and presence of dominant ethnic population in the Gulf, UK and US are the strengths of India. Low level of processing and value addition, highly disorganized and fragmented supply side and geographical distance from terminal markets are India's weakness.

India is having good network of organizations for conducting research in coconut. Central Plantation Crops Research Institute (CPCRI) was established in 1970 as one of the agricultural research institutes under the Indian Council of Agricultural Research (ICAR). An International Coconut Gene Bank for South Asia (ICG-SA) was established at Kidu, Karnataka in 2013.The Research Centre at Kidu helps to cater to the needs of the farmers by supplying elite planting materials of the mandate crops, in addition to serving as the International Coconut Gene Bank for South Asia.

The All India Coordinated Research Project on Palms, started in the year 1972, is coordinating research in coconut, oil palm and palmyrah in different agro-climatic regions for the identification of location specific technologies. The project provides adaptive research support for coconut through collection, conservation, cataloguing and evaluation of germplasm, evaluation of new hybrids and high yielding varieties of coconut, standardization of agro-techniques for various agro-climatic regions including development of appropriate farming systems and development of efficient pest and disease management strategies. Some of the coconut research achievements in India are given below.

• World's largest germplasm collection of coconut comprising 398 accessions is being maintained in CPCRI. The Gene Bank includes exotic collections from 28 countries of South Asia, South-East Asia, Africa, Caribbean Islands, Indian Ocean Islands and Pacific Ocean Islands.

• Breeding efforts at CPCRI and State Agricultural Universities have resulted in the release of eighteen varieties and fifteen hybrids suitable for different parts of the country.

• A protocol for aseptic collection of embryo in coconut, their storage during transport and successful culture to develop plantlets has been standardized and used in collection of exotic coconut accessions for conservation in the gene bank. This is found to be very useful in field collection of coconut germplasm from distant places.

• The protocol for plumule culture of coconut has been standardized

• In vitro active conservation of coconut zygotic embryos (short-term) was standardized.

• Cryopreservation of coconut pollen was standardized and viability/ germinability could be maintained even after the pollen was cryopreserved for 16 months.

Programmes and Policies to Promote Development of Coconut Sector

In India, development programmes in coconut are mainly undertaken by Coconut Development Board under the Ministry of Agriculture and Farmers Welfare. The programmes undertaken during the last year for the benefit of farming community are listed below along with the overall growth of coconut sector.

Production and distribution of planting material

Establishment of Demonstration cum Seed Production (DSP) Farms in different parts of the country for creating infrastructure facilities for production of quality planting materials besides demonstrating and educating the scientific coconut cultivation and processing to various stake holders in those regions, establishment of Regional Coconut Nurseries for extending support to various participating States for strengthening the seedling production programme, distribution of hybrids/dwarf seedlings in Govt. sector, establishment of Nucleus Coconut Seed Garden and coconut Nurseries in private sector are taken up under this programme. Last year nearly 20 lakh seedlings were produced and distributed under this scheme. 10 DSP farms are established in different parts of the country.

Expansion of Area under Coconut

This programme is to extend adequate technical and financial support to the farmers to take up coconut cultivation on scientific lines in potential areas to attain a significant achievement in the future production potential. Financial and technical assistance is extended under the scheme for taking up new planting of coconut in potential areas.

Integrated Farming for Productivity Improvement programmes

The objective of the programme is to improve production and productivity of the coconut holdings through an integrated approach and thereby increasing the net income from unit holdings with the following component programmes under Laying out of Demonstration Plots and establishing Organic Manure Units by providing incentives.

Technology Demonstration/Quality testing lab

The Technology Development Centre set up in Kerala is engaged in the development and demonstration of technologies for product diversification and by-product utilization of coconut. The centre is devoted to product development, microbial analysis of coconut based products apart from skill development programmes to interested entrepreneurs and self help groups for acquiring technologies on post harvest coconut processing and process demonstration. The Institute received the recognition of NABL. Many value added and novel products were developed by the institute during the last year and the institute is designated as CDB Institute of Technology (CIT).

Marketing, market intelligent services, Statistics and Export Promotion Council

Under this scheme, activities such as Market information and intelligence service, modernization of coconut processing by the introduction of improved copra dryer/other processing machineries/equipment, surveys and evaluation studies including concurrent estimation of coconut production and productivity and activities of export promotion council are undertaken.

Information and Information Technology

The Board is disseminating information on various aspects of coconut cultivation and industry through various media and publications besides organizing training programmes to impart skills and knowledge to farmers, unemployed youths and rural women in various fields related to coconut apart from participation in exhibitions and fairs under this programme.

Technology Mission on Coconut

The Technology Mission on coconut gives emphasis on the development of technologies for the management of insect pest and disease affected gardens and product diversification besides demonstration and promotion of these technologies for adoption. Under the Mission, research projects and clinical studies are sponsored through reputed institutions in the area of technology development and also to establish the medicinal and nutraceutical properties of coconut products especially coconut oil. Last year technical and financial support was given to establish 61 processing units with processing capacity of 330 million nuts per year. Subsidy of Rs.145.4 million (US $ 2.22 M) was extended to entrepreneurs and manufacturers of desiccated coconut(DC), virgin coconut oil(VCO), coconut oil (CNO), packaging of tender coconut water(TNW), flavoured juice etc. So far 402 processing units have been established in the country under the financial assistance of TMoC

Replanting and Rejuvenation of Coconut Gardens.

In pursuance to PNG declaration in 2006, India initiated Replanting and Rejuvenation of traditional coconut gardens in the country. To begin with, the programme was introduced in Kerala, the state with longest history of coconut cultivation where $1/3^{rd}$ of palm population was old, senile and disease advanced. Apart from the longest recorded history of coconut cultivation, the state is under the grip of a lethal disease called root

wilt. Cutting and removing the disease advanced trees and giving management care to the existing palm population is the only strategy to manage the gardens. Therefore the R&R programme was implemented in the state from 2009 and is still continuing. The main objective of the scheme is to enhance the productivity and production of coconut by removal of disease advanced, old and senile palms, replanting with quality seedlings and rejuvenating the remaining palms by giving compensation to farmers for cutting and removal, replanting and rejuvenation. So far more than 3.3 million palms have been cut and removed under the scheme and nearly 5 lakh ha was rejuvenated.

Coconut Palm Insurance Scheme (CPIS)

The Coconut Palm Insurance Scheme intends to provide insurance coverage to coconut crop. Under the scheme all healthy bearing palms in the age group from 4 years to 60 years are eligible to get insurance coverage against natural perils leading to death / unproductive. 50% of the premium is borne by the Board and balance is shared between the State Govt. and farmers @ 25% each.

Kera Suraksha Insurance Scheme for Coconut Tree Climbers (CTC)

The 'Kera Suraksha' Insurance Scheme provides insurance coverage to the coconut tree climbers (CTC) @ Rs.2 lakh against 24 hours accident related risk including death. 75% of the annual premium of the policy is borne by the Board and the 25% by the beneficiary. The scheme is implemented in all coconut growing states.

Establishment of new Coconut Orchards

The objective of the scheme is to improve the production and productivity of coconut by establishing coconut orchards with high yielding varieties released by research institutes for different agro climatic conditions. The scheme is implemented through Farmer Producer Organization (FPO) in coconut growing states including scheduled and hilly areas

New policies and initiatives

Three tier Farmer Producer Organization (FPO) in coconut sector.

Coconut Development Board (CDB) has facilitated the formation of three tier Farmer Producer Organization (FPO) with Coconut Producers Societies (CPS) at primary level and integrate them to form Coconut Producers Federation (CPF) at intermediate level and Coconut Producer Company (CPC) at apex level. A Coconut Producer Society (CPS) consists of around 50 farmers and 5000 coconut palms and 20 such societies form Federations and 10 Federations form a company. Thus a company which is formed by 10,000 farmers will be producing around 8 crore coconut from their jurisdiction. The main role of the Company is to establish processing unit for production of value added products from coconut procured from the member farmers. There are at present 9251 CPS, 716 CPF and 65 CPCs functioning in the country.

Skill Development Training Programmes (Friends of Coconut tree (FoCT)

Acute shortage of palm climbers to harvest and adopt plant protection measures is one of the problems faced by coconut growers. With a view to tackle this problem, the Board is conducting skill development programme from 2011-12 onwards, to train unemployed youths in developing special skills and confidence in coconut climbing and plant protection activities for the benefit of coconut farming community. The skill fetches the youth handsome income for their decent living and help to make available sufficient manpower to society in coconut climbing.

Promotion of Neera production and marketing

Coconut Development Board has developed the technology for neera harvesting and processing Neera, the vascular sap from coconut inflorescence is one of the most profitable value added products from coconut. Considering its nutritive value, health benefits and profitability its production has been permitted by the major coconut growing states. Coconut Development Board has taken the initiative for developing a pool of Neera technicians. This is achieved in two phases, the first phase concentrating on moulding traditional toddy tappers into Neera Master Technicians through a training conducted at the CDB Institute of Technology (CIT) for a duration of two weeks. These master technicians in turn will train interested and eligible candidates at the respective Coconut Producer Company and Federation levels.

Product Development

India was lagging behind in technology development for product diversification till the last two decades. Introduction of Technology Mission has given momentum

to this area and now India possesses many technologies in value addition. Acceleration to the activities of CDB Institute of Technology, further quickened the products development. Technology for processing and packing of neera and various down stream products like neera sugar, jaggery, honey etc have been developed. Food products like sweet/spicy chips, sweet chunks, chocolate, cookies, burfi, lemonade, flavoured juice, ice cream and milk spread are also the other new additions of CIT's contribution to the coconut product basket.

Product basket from coconut - Value added coconut products
Water based
Packed Tender Coconut Water, Coconut Vinegar, Nata de coco etc.
Kernel based
Coconut Oil, Virgin Coconut Oil, Desiccated Coconut, Ball Copra, Coconut Cream, Coconut Milk Powder, etc.
Inflorescence sap (Neera) based
Neera beverage and Neera based value added products etc.
Shell based
Shell Powder, Shell Charcoal, Activated Carbon, etc.

Marketing Strategy

Having achieved considerable progress in value addition and product development, India has to embark upon new marketing strategy for directing coconut products to all domestic and international markets. The current trend in domestic and international markets for various products is encouraging. While considering the domestic market it could be seen that urban India comes ahead of USA in the order of populous nations. The population of urban India is about 360 million which is above the total population of USA. Population of USA is only 315 million. Our domestic market is bigger than that of USA if 75 % urban population is taken into account. More than 78% of India's urban population is located in the 63 major cities. India is aiming at introducing, making available and marketing maximum value added coconut products in these cities. In the international markets, countries like China, India, USA, Indonesia and Brazil are top five most populous countries. In this era of globalization, products of all countries are available in all potential markets. Coconut products of India have to reach the markets of other countries. But quality adherence assumes significance. India is giving thrust to manufacture best quality products with attractive packaging through innovative marketing strategies. By giving further boost to Indian opportunities, niche markets for pharmaceutical, nutraceutical, and cosmecuetical products with coconut as major ingredient are emerging. India will take the advantage of such new developments.

Future thrust

Indian coconut sector has to improve in many areas in spite of unprecedented progress achieved in selected sectors. There are many issues to be addressed and solutions arrived at. Inadequate availability of quality planting material in tune with the increasing demand, low pace of value addition, low level of productivity than the potential, low pace of expansion of crop and low level of Replanting and Rejuvenation of old plantations, and the non availability of disease tolerant and short statured high yielding varieties are issues which need solution. Against the annual requirement of 10 million seedlings, the present supply of is only 3.5 million seedlings. Considerable area suitable for coconut is available in traditional and non-traditional areas in the country which need to be utilized for expanding the crop. Through convergence of various programmes and bridging the gap in existing schemes, India will try to make coconut a more remunerative crop by enlarging the scale and size of operations and reducing production costs giving more thrust on irrigation, drought management, and soil and moisture conservation. Restructuring of planting population giving more stress on hybrids and dwarf and more diversion of production to value addition, improvement in quality standards matching with international standards, adoption of new marketing strategy for tapping domestic and international markets and widening the skill development in all essential areas of production and processing will be other areas of priority. More focus need to be given on popularizing the health, nutrition and wellness benefit of coconut in the national and international level.

Conclusion

Indian Coconut sector is striving hard to grow further for the benefit of millions of farming community. The country is aiming at sustaining the premier status enjoyed at global level in production and productivity and also in the process of gaining the prime position in export front too. India look forward to have collaboration and involvement with APCC, its member countries and other international organizations in collaborative research especially on coconut oil, development of new varieties resistant to biotic stress, exchange of technologies, joint ventures in coconut sector etc. ■

** Paper presented by Dr. A.K. Singh, Chairman, CDB during the 47th Cocotech meeting held during 26-30 September at Bali, Indonesia*

Own Your Seedlings

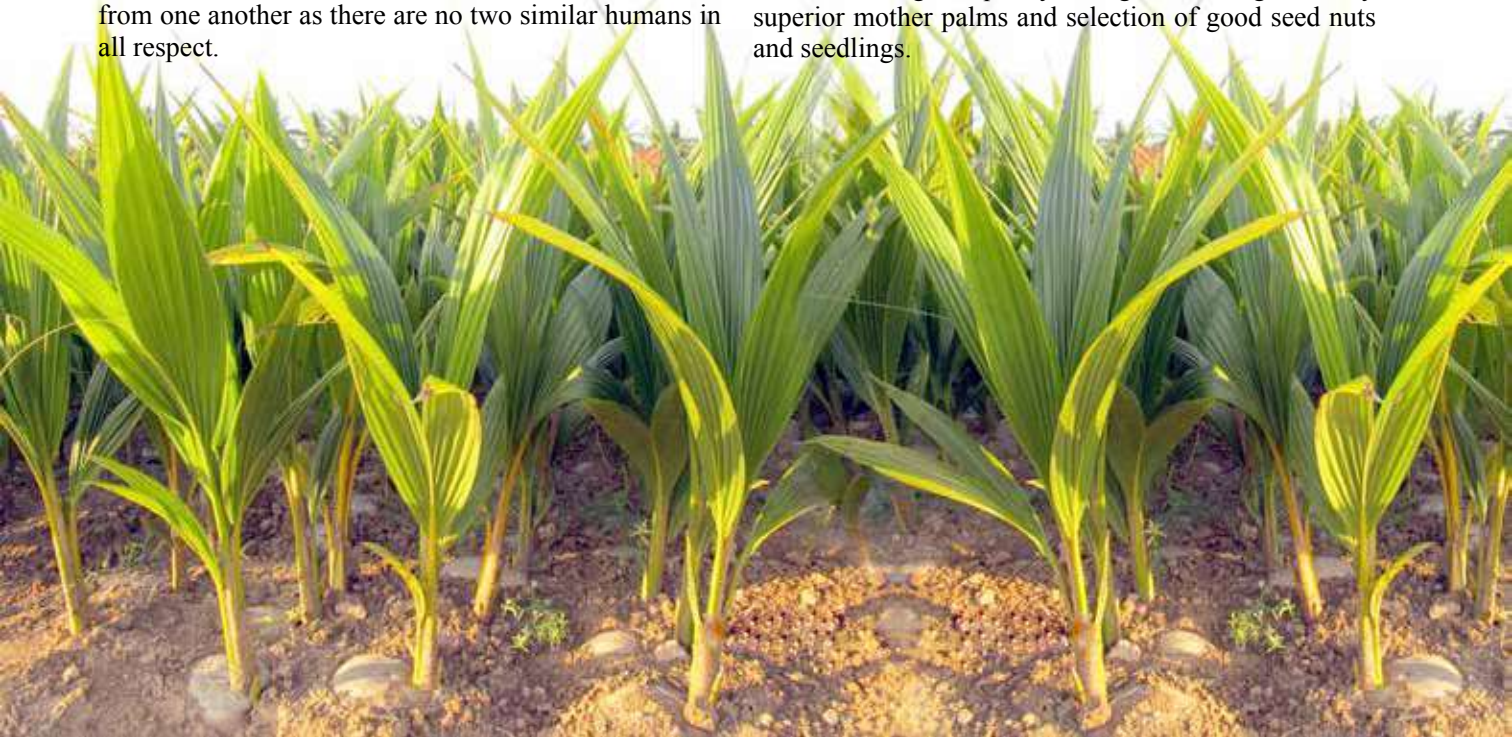
● **T.I.Mathewkutty,** Chief Coconut Development Officer & **Deepthi R.** Technical Officer, CDB, Kochi-11

The coconut palm otherwise called the tree of heaven is a tropical palm species well known for the diversified products derived from it. From age old period coconut has been playing a vital role in the daily life of people especially in tropical countries. Coconut a major source of vegetable oil accounts as a source of food, fiber and beverage. Coconut is much adapted for cultivation in various climatic zones varying from islands, seashores, plains and hills. Coconut is bestowed with the name "Tree of Life" as its each part can turn into useful products. A number of products which can sustain the human life can be derived from nut, husk, frond, inflorescence and trunk of a coconut palm; thus serving local and international markets.

South East Asia is considered as the centre of origin of coconut and disseminated to other areas through natural means. In early years sailors across various countries took coconut from different coconut growing islands where wild coconuts were predominant. This has resulted in cross pollination and in the emergence of new cultivars. Coconut being a highly cross pollinated crop; the seedlings raised also show variations from the ancestor palm. Seedlings derived from parent palm may show characteristics of either or both the ancestral palms. Thus each coconut palm is different from one another as there are no two similar humans in all respect.

Planting of quality seedlings- the basic step in profitable coconut cultivation

The perennial nature of crop demands a minimum of 5-6 years for attaining a stable yield. This prolonged pre bearing period makes the selection of planting material an item of utmost importance. Any error in selection of planting material may result in huge loss to the time and money of the farmer. One of the reasons for reduced production of coconut in the state is believed to be the cultivation of genetically poor quality coconut seedlings. The selection of genetically pure seedlings in the state of Tamil Nadu has come up with promising results. As there are no rapid multiplication techniques available in coconut seedling production, we have to depend on the traditional method of raising seedlings from selected good quality seed gardens for genetically superior mother palms and selection of good seed nuts and seedlings.



Estimated demand for seedlings in coconut growing states			
State	Area "000" ha	No.of palms (in lakh)*	Seedlings demand estimated (in lakh)**
Kerala	649.85	974.775	9.75
Karnataka	515.03	772.545	7.73
Tamil Nadu	465.11	697.665	6.98
Andhra Pradesh	105.99	158.985	1.59
Odisha	50.68	76.02	0.76
Gujarat	31.63	47.445	0.47
West Bengal	29.41	44.115	0.44
Maharashtra	28.1	42.15	0.42
Other states	100.01	150.015	1.50
Total	1975.81	2963.715	29.64
* planting density 150 palms per hectare			
** seedlings for 1% replanting per year			

The demand for quality seedlings from the coconut cultivating states is estimated to be around 30 lakh seedlings every year. The estimation is based on the assumption that atleast 1% of the total cultivated coconut palms are replanted / newly planted every year. In the state of Kerala alone, there is need for about 10 lakh coconut seedlings.

Seedling production (in numbers) from CDB farms over last five years					
DSP Farm	2011-12	2012-13	2013-14	2014-15	2015-16
Mandya	135493	258092	228199	145589	161302
Vegiwada	61198	81607	316360	14714	63853
Neriaman-galam	16088	98597	130928	147825	129123
Pitapally	17083	93028	299566	65025	111422
Kondagaon	7104	92446	120818	100278	40541
Madhepura	6377	103580	162204	0	500
Abhayapuri	16507	122979	63519	290316	19286
Palghar	0	0	5256	21214	67682
Dhali	0	0	0	0	73541
Total	259850	850329	1326850	784961	667250

However only a few agencies like Coconut Development Board, Central Plantation Crops Research Institute, Kerala Agricultural University, Dept of Agriculture and few private nurseries are producing

quality coconut seedlings. Production from such sources is not enough to meet the demand for seedlings. This often makes the farmers to depend on unreliable sources for seedlings. Farmers often get cheated by many false practices in seedling production sector too. One way to get rid of the situation is the production of own seedlings.

Believe it or not; there are super palms

Selection of mother palms for production of quality seedlings is an important step in scientific and traditional nursery raising. The mother palms having characteristics such as good health, free from pest and diseases, stable yield etc are selected for the purpose of seed nut collection. The palms having above the average yield ie 80 nuts per palm per year are usually selected for the purpose. But in almost all the coconut growing areas you can find certain palms (about 3% to 5%) giving an yield always higher than 80 nuts per year. Such palms may also show high pest and disease resistance. These palms are called the Super Palms. Such palms can be seen even in the high intensity disease incidence areas. Production of coconut seedlings from such super palms was widely adopted by our forefathers when seedling production was not taken up by Government agencies viz Coconut Development Board, Central Plantation Crops Research Institute or Kerala Agricultural University, Dept of Agriculture.

The Farmer Producer Organizations in each area can identify such high yielding disease free super mother palms of their area. These palms will be indigenous with characters adapted to those peculiar climatic features. Such palms have to be selected locally for collection of seed nuts and further production of seedlings. Thus the traditional knowledge of selecting disease resistant palms from local sources for seedling production is to be promoted.

Polybag Nurseries: A way to avoid transplanting shock

Polybag nurseries are nowadays a common practice in nursery raising. Seednuts are sown in the soil and on germination, initiation of the seedlings are transplanted to polybags. Black polybags of size 60 x 40 cm with 500 gauge are used for transplanting. Potting mixture in the ratio 2:1:1 comprising of top soil, sand and FYM/ vermi compost need to be used. The major advantage of polybag nurseries is that it will avoid transplanting shock while uprooting the seedlings from nursery. Easy establishment of seedlings, vigorous seedling growth and early flowering are the added advantages. The mortality rate in gardens planted with polybag seedlings is much lower than gardens planted with uprooted seedlings. A change in the common polybag nurseries can also be tried while producing seedlings. Instead of going for transplanting the germinated seednuts, direct sowing of nuts in the polybags can be adopted. Thus the chances of even the minute shock can be avoided and seedlings with good vigour and good root system can be obtained.While planting polybag seedlings in the main field, adequate care should be taken to avoid any disturbances to seedlings. While planting, the sides of the polybag may be cut vertically along the sides with sharp blade/knife and planted along with the full mud (potting mixture) inside a big size pit made in the field.

Seed nut villages

Seed villages are a common concept in many other horticultural crops. It is a way to organize seed production in villages so as to make available seeds at the door step of farmers at the right time. As the production of seeds is done locally with participation from farmers the cost can also be reduced considerably. Hybridization training can be taken up for production of hybrids suited to the area. DxT hybrid seedlings of coconut is the most sought of this and recommended variety for which there is great demand. DxT hybrid seedlings produced by private nursery costs between Rs.350/- and Rs.500/- per seedling and the farmer has to wait about one to two years after booking for getting the seedling. One of the main reasons for the short supply of the same is due to low availability of dwarf mother palms where the hybridization is to be done. After selecting the dwarf mother palms one has to wait for 24 months to produce a hybrid seedling. Farmers having few dwarf palms can also produce DxT hybrids by pollinating the mother palms with selected good quality pollen collected from the desired tall male parent.

Training on nursery raising, pollination and hybridization are conducted by Coconut Development Board. The Board also extends financial and technical aid for establishing small nursery units. The same can be availed by farmers and Farmer Producer Organizations. The Farmer Producer Organizations can attain self sufficiency and self reliance through creation of such seed coconut villages.

The demand for seed nut and seedling is escalating day by day. As the number of healthy palms in the state is decreasing and the requirement for quality coconut seedlings is increasing; bulk production of quality coconut seedlings has to be taken up through collaboration with various agencies in the sector. ■

Mangosteen and Rambutan

- New companions for coconut

R. Jnanadevan, Dy. Director CDB, Kochi-11

Coconut is a crop prefers to grow along with other companion crops. Hence coconut based cropping system is promoted where ever it grown. It enables better utilization of natural resources and improves the soil fertility due to the continuous biomass addition by the subsidiary crops also for generating higher income from coconut garden. Besides, coconut as a mono crop does not fully utilize the basic resources like soil, water and sunlight available in the garden. These holdings neither provide gainful employment opportunities for the family labour throughout the year nor generate sufficient income to meet the family requirement. Several crops like cocoa, nutmeg, clove, cinnamon etc are identified through research as good companion crops for coconut. Farmers are looking for best companion crops in coconut garden. In a scientifically planted coconut garden at a spacing of 25 feet x 25 feet, only 25% of soil is being used by coconut and the remaining soil is left aside for growing suitable inter/mixed crops.

Now with the increase in labour cost, farmers are thinking of cultivating more suitable money spinning companion crops in coconut garden which gives higher income with lesser cost. Two new conventional fruit crops that attract the farmers as money spinning intercrops in coconut garden are Mangosteen and Rambutan. Farmers in costal Karnataka and some parts of Kerala have already successfully tried these crops in coconut garden as companion crops. These two crops were introduced in India in the 19th century. Cultivation

of Rambutan and Mangosteen is becoming popular in the western coast, particularly Kerala and Karnataka. Currently, there is good market for these fruits. According to farmers of Kerala, the entire production of Rambutan and Mangosteen is getting sold within a week during the harvest season, which shows the increasing demand for these nontraditional fruits among the people. Since these fruits are not popular in the market, most people may not get the chance to taste these wonderful fruits. But on tasting the juicy flesh, people may feel that why I was not aware of this fruit before. Such an impact of these fruits are slowly finding ground in states like Kerala and Karnataka. Mangosteen along with the attractive red color of Rambuttan has caught the attention of farmers of south India.

Rambutan (Nephelium lappaceum) is propagated through budded plants which start yielding from the third year of planting. But 50% of the seedlings may be male which cannot bear fruit. Rambutan shall be planted in 3 X 3 ft pits in the middle of two rows of coconut palm at a spacing of 25 X 25 ft. It needs to undergo training and pruning in order to arrest the plant growing wild. This is done either by cutting down the height of the plant after 6 – 8 months of planting and after new shoots sprout and mature, at a height of less than 3 feet. While doing this, one must make sure that the plants have at least 10 leaves beneath the cutting portion to protect the plant from dying out. It requires deep, well-drained soils. Acid soils (pH 5.5 to 6.5) with high organic matter are very suitable but most important are a good supply of suitable water and protection from wind. Rambutan being a hard wood tree needs very little maintenance and the life expectancy of this plant is considered to be more than 40 years. Post harvest pruning is the major critical job for arresting the wild growth of the plant and to maintain its lateral growth and shape. Fruiting of young trees is spread from December to August due to extended flowering patterns. As trees mature, they settle into one main fruiting per year. Rambutan fruits take 120-150 days to ripen after flowering and can remain in the tree upto 30 days after ripening without any damage leaving the farmer with no compulsion to sell out his produce but rather enable him to do it in a suitable manner so as to realize the best value for the fruit.

Mangosteen (Garcinia mangostana) is delicious and juicy and is one of the popular tropical fruits considered to have better potential due to its high medicinal value. It comprises of an impressive list of essential nutrients which are required for normal growth and development and overall nutritional well-being. It contains no saturated fats. It is rich in dietary fiber and is a good source of vitamin C which is a powerful water soluble anti-oxidant. Consumption of fruits rich in vitamin-C helps human body develop resistance against viral diseases. Fresh fruit is a moderate source of B-complex vitamins such as thiamin and niacin. It is prorogated through seedlings.

A spacing of 25 to 30 ft is recommended for planting these fruit plants. In coconut garden one plant can be planted in the middle of two rows of coconut palms planted at a wider spacing of 9x9 ft or in the boundaries. Planting is preferably done at the beginning of the rainy season. Pits of 1.2 x l.2 x l.3 m are prepared at least 30 days in advance, enriched with organic matter and top soil and left to weather. The young tree is put in place very carefully so as not to injure the root and is given heavy watering. Partial shading with palm fronds or by other means should be given in the initial years. Average yield of a full-grown Mangostein tree is about 500 fruits. The yield steadily increases up to the 30th year of bearing when 1,000 to 2,000 fruits can be obtained. In Tamil Nadu, individual trees between the ages of 20 and 45 years have borne 2,000 to 3,000 fruits. Productivity gradually declines thereafter, though the tree will be fruiting even at 100 years of age.

The harvesting season of mangosteen is between April and June and for rambutan between May and August. Rambutan is more popular among growers due to its early yielding feature and mangosteen is considered to have a better potential due to its high medicinal value. Many of the farmers in coastal Karnataka and Kerala are interested in taking up the cultivation of both these fruits. 1 kg pack of Rambutan and Mangostein on an average fetches Rs. 200 at the farm gate. Of course these two crops are remunerative high value inter crops in coconut garden for future and farmers will get an income of around Rs. 1,50,000 to Rs.2,00,000 per acre from these crops. Many farmers from coastal Karnataka and Kerala in the western region have taken up cultivation of both these fruit crops. The seedlings are normally sourced from private nurseries. Seedlings/ grafts of these crops are also available at sales counters of Kerala Agricultural University, Mannuthy Phone. 0487-2438011, Regional Agricultural Research Station, Ambalavayal Phone. 04936-260421 and Indian Institute of Horticulture, Bengaluru, Phone: 080 2844 6386 ■

Coconut leaf craft

A participatory reflection on reviving an ancient art tradition

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Coconut, the versatile tree crop, profoundly influences the socio-cultural and economic activities of people in various parts of the world. It is eulogised as 'Kalpavriksha' – the 'tree of heaven' as each and every part of the palm is useful to mankind in one way or other. Coconut leaves have an important role in the rural life. The human-coconut leaf relationship starts right from the childhood and it continues up to the last rites. Coconut leaves are used for making toys and craft items, decoration and ritual purposes and different stages of leaves, from tender leaves to dry leaves are used for different purposes.

Coconut leaves and leaf craft

Dry coconut leaves and leafstalks were used for fuel purpose in rural homesteads. Some rituals were performed under the light provided by burning 'olachoottu', small bundle of dry coconut leaves tied together. Plaited coconut leaves were extensively used for thatching roofs of houses, for sunshades, matting for floor as well as walls. Shelters made from coconut fronds are cheaper and cooler than brick and mortar structures. For construction of Pandals (big halls) for meetings, marriages etc plaited leaves are used. Big baskets also made from half split coconut fronds which is dried and plaited. Coconut leaves have a prominent place in the ritual worship of village deities like *Theyyam, Thira, Padayani, bhoothakula etc.* Tender coconut leaves are liberally used in the costumes of these deities, especially Theyyam and Thira. During 'Hosanna' or 'Palm Sunday' tender coconut leaves (kuruthola)are used. The same is used during 'Ash Wednesday' as well.

Tender coconut leaves are used for decorating purposes in auspicious functions. *Thalappoly,* the traditional welcome of guests/ dignitaries, tender coconut leaves and split coconut in which the vick is burned in coconut oil is used. In household medicinal preparations also coconut leaves find a place. The extract of tender leaves is administered in cases of body pain. A symbolic treat offered all throughout Indonesia is rice cooked in packets made from fresh coconut leaves called ketupat.

The art of using coconut leaves for decorative purposes is popularly known as puni in the Philippines.

The economic and socio-cultural activities of people of Lakshdweep islands are closely woven around coconut palm and coconut leaves have a role in the major sources of livelihood in the Islands viz., fishing, copra making and tourism. Coconut leaf is an unavoidable component in the traditional fishing boats. The baskets for fish collection, different types of hats etc are made of coconut leaf. Dry coconut leaves are used to make temporary fences and floor used for drying of copra. Natural huts with thatched coconut leaf roof are a fascination for the tourists from various parts of the world visiting the islands and children holding toys made from coconut leaves are a regular feature of the beaches.

The rich heritage of coconut leaf craft which was integral part of socio-cultural and daily life of rural people is slowly fading away. In this fast paced modern era synthetic materials like plastics are replacing the coconut leaves for the varied uses in crafts and even in rituals. Meaningful interventions are required for reviving the rich tradition of coconut leaf craft.

Workshop seminar and exhibition on coconut leaf craft

A workshop-cum-seminar and exhibition on coconut leaf craft was organised during 06-10 September 2016 at CPCRI campus, Kasaragod with the objective to create awareness among the present generation about coconut leaf craft tradition and to discuss about ways and means of sustaining it. The programme was conducted by ICAR-Central Plantation Crops Research Institute as part of its centenary celebrations in collaboration with Folkland (International Ccentre for Folklore and Culture), an organization devoted for conserving intangible cultural heritage and INTACH, Indian National Trust for Art and Cultural Heritage.

About 20 selected coconut leaf craft artists from different parts of Kerala state participated in the programme, besides designers and artists with other backgrounds. It was a residential programme and workshop sessions with discussions, demonstrations and hands on training sessions on leaf craft designs involved lot of time and hence the sessions were stretched to late evening hours. Sessions were mostly lead by Theyyam artists since they are the main stakeholders of coconut leaf crafts. The programme also had the presence of eminent academicians in the field of art history, social anthropology and folklore studies in the inaugural function, seminar and valedictory function. Scientists from CPCRI participated in the seminar and lead the discussion on the research needs for evolving techniques for preserving coconut leaf craft materials and enhancing storage life. As part of the programme children from nearby school were facilitated to meet and interact with the coconut leaf craft artists at work and they also had the opportunity for hands-on training for making toys and craft items using coconut leaves.

Workshop was inaugurated by eminent art historian Mr. K.K. Marar. In his inaugural speech, he gave a brief account of coconut leaves in the life of people of Kerala. Dr. H.P. Maheswarappa, Director -in- Charge of CPCRI presided over the inaugural function. Dr. V. Jayarajan, Chairman of Folkland and Convener of INTACH Kasargod Chapter made introductory remarks. Prof. A. Sreenath, and Dr. K. Muraleedharan offered felicitations. Dr. C. Thamban, Principal Scientist and Head of the Division of Social Sciences, CPCRI, welcomed the gathering and Advocate P. V. Hareesh, Co-convener of INTACH proposed the vote of thanks.

The artists and craftsmen who led the workshop included 89 year old Mr. Andi Panikker an eminent coconut leaf crafts man and Kerala Folklore Academy

fellowship recipient, Mr. Ravindran Panikker, eminent coconut leaf crafts man and Kerala Folkore Academy Award winner, Mr. Avala Shivadasan, Mr. Pradeep, Mr. Sukumaran, Mr. Ashoka, Mr. Ramesan, Mr. Jithin, Mr. Chandrasekharan Nambiar, Mr. Manoj, Mr. Madhusoodhanan, Ms. Aneesha, Ms. Rajitha, Ms. Sreeja and Mr. Sureshan.

During the workshop the artists and craftsmen demonstrated use of tender coconut leaves for making toys like birds, flowers, watches, spectacles, flies etc, decorations and craft items for ritual purposes, use of mature leaves for making different types of baskets, coconut leaf umbrella, coconut leaf chappels etc, and use of dry leaves for making roofing, fencing, curtains, partitions etc. Mr. K. R. Babu, eminent mural painter made a stage decoration design with tender coconut leaves. He was assisted by artists Mr. Unnikrishnan, and Mr. Purushothaman. Large number of people including students, artists and media personnel visited the workshop site and interacted with the artists and craftsmen at work. Besides, during the workshop there was lot of interaction and cross learning among the participants about various aspects of use of coconut leaves for various purposes.

The seminar was held on 8th September 2016 on the theme 'Coconut leaf craft and Kerala society'. Dr. C. Thamban, Head, Division of Social sciences, ICAR-CPCRI welcomed the gathering. Dr.V.Jayarajan, Chairman, Folkland was the moderator of the seminar. He introduced the theme and scholars presented papers in the seminar.

Eminent Theyyam artist and scholar Aduthila Kunhirama Peruvannan in his presentation narrated the use of coconut leaf crafts in the ritual dance of Theyyam especially the extensive use of 'flowers' made out of coconut leaves in the costumes of Theyyam. He cited the example of the very famous deity, Muchilottu Bhagavathi and said that even though tender leaves are not much used for its costume, the head gear is brightened with beautiful flowers called "Mallika" made of coconut leaves. He also described the use of coconut leaf craft in many other Theyyam deities such as Vishnumoorthy, Chamundi, Pottan etc.

Dr. Dineshan Vadakkiniyil, Assistant Professor, Government Brennen College, Thalasseri in his presentation spoke on the changing socio-economic and cultural values of coconut leaves in the lives of Keralites. Though the dependence of rural population of Kerala on coconut for their economic needs is on the decline, coconut leaves have a prominent place the cultural life of the Keralites. They are still extensively used in the ritual worship of village deities like Theyyam, Thira, bhoothakula etc.

Dr. Shameena Beegum, scientist, ICAR-CPCRI briefly narrated the use of coconut leaves for various purposes by people in different regions of the world. She described how coconuts leaves continue to find a prominent place in the major income generating enterprises in Lakshadweep islands. She further presented the details of experiment conducted at ICAR-CPCRI for evolving methods to preserve the fresh colour of coconut leaves. The practical difficulty experienced by the performers of rituals as well as craftsmen was the difficulty to preserve the fresh colour of various coconut leaf based craft materials. Bruises/cuts made on coconut leaves while preparing craft items hasten the loss of colour and appearance. Taking into cognizance these constraints, a preliminary experiment was initiated at ICAR-CPCRI with the objective of assessing the materials and methods of preserving the fresh colour of coconut leaves especially the tender leaves. Experiment was designed taking into account the basic concept of cut foliage. Cut foliage can be defined as leaves or part of leaves along with stems, branches with / without decorative fruits or other parts. It can be used in interior decoration and also for bouquets.

Once the petiole is cut for collecting coconut leaves an atmospheric pressure forces air into the water ducts leading to creation of vacuum which results in wilting

of the leaves. Hence, to prevent wilting it is necessary to create congenial environment to stop the air entry such as conditioning, pulsing, holding etc. The methods of preservation may vary according to the end uses/ purposes such as whole spindle leaf meant for transportation to distant locations, spindle leaf cut to pieces for making crafts, toys etc., and mature leaf for making hats, baskets, thatching etc. Controlled drying, use of preservatives / anti browning agents and conditioning/ pulsing / holding treatments were the methods employed for preservation as part of the experiment. Under open condition the leaves were completely dried within 24 hrs, while it stayed fresh for four days under controlled drying at room temperature (30±2ºC) along with provision of air. The effect of various preservatives such as salt (2%), sugar (2.5 to 10%), citric acid (2%), potassium meta bisulphate (0.5%) and their combinations were evaluated. The results of the experiment indicated that the spindle leaves can be preserved afresh upto 13 days with the treatment containing 5% sugar solution.

Further studies are required to standardize the preservation techniques. It is also worthwhile to evolve techniques for utilizing coconut leaves for dry flower arrangement. Effectiveness of the indigenous practice of warm water treatment adopted for preserving palmyra/ banana leaves was evaluated in coconut leaves and observed that the treatment was effective to retain the freshness and luster of the leaves for 4 days under room temperature.

After the presentations discussion was held. Difficulty to collect coconut leaves and apprehensions of coconut growers to supply coconut leaves, especially spindle leaves, was also perceived as a constraint experienced. Hence, it is very important that after cutting coconut leaves the cut portion is treated with wound dressing fungicides to avoid infection and incidence of bud rot diseases etc.

The exhibition of craft items created during the workshop continued up to 10th September 2016 at Agricultural Technology Information Centre, CPCRI campus and large number of visitors were attracted by the leaf craft items exhibited.

Dr. Shreeram Shetty, Professor and Head, Department of Kannada, Mangalore University, was the chief guest in the valedictory session. In his address Dr. Shetty narrated the significance of reviving ancient art tradition including coconut leaf craft. In the present day context of globalization, it is very relevant to preserve the cultural diversity in the villages and indigenous knowledge prevalent among the rural people.

Dr. P. Chowdappa, Director, ICAR-CPCRI chaired the valedictory session. In his presidential address Dr.

Chowdappa offered the support of CPCRI in the efforts for reviving the coconut leaf craft tradition. He thanked Folkland and INTACH for collaborating with CPCRI for conducting the workshop and seminar on coconut leaf craft.

Dr. V. Jayarajan, Chairman Folkland and Dr.C.Thamban, Principal Scientist and Head, Social Science Division, ICAR-CPCRI in their introductory remarks described the background of planning and implementing the collaborative efforts for bringing together artists/craftsmen and successfully organizing the programme.

Certificates were distributed to the participants by Dr.Chowdappa, Director, CPCRI. Mr. K. Sureshan welcomed the gathering and Dr. D. Jagannathan proposed the vote of thanks in the valedictory session.

Way forward

Many suggestions were made by different stakeholders during the discussions and deliberations of the programme to revive the tradition of the coconut leaf craft art tradition. Important among them are furnished below.

• Programmes are to be implemented to promote coconut leaf craft as an intervention to foster environment friendly culture in the present day context of environmental pollution caused by the indiscriminate use of synthetic materials like plastics. Such programmes to promote coconut leaf craft would provide an opportunity to people of this generation to realise the close relationship that human being once had with the nature but lost in the course of modernization.

• It is necessary to formulate and implement interventions to provide opportunity to children to interact with artists and craftsmen involved in coconut leaf craft and learn from them the art and skill. An enquiry should be made to know the possibilities of converting coconut leaf craft as a vocation.

• Training-cum-workshops on coconut leaf craft are to be conducted at different localities to benefit rural youth and self help groups who show keen interest in acquiring the required skill in coconut leaf craft. Expertise available with the experienced traditional artists and craftsmen can be effectively utilised for conducting such capacity development programmes.

• The potential of effectively linking the coconut leaf craft with tourism should be fully utilised. In the craft villages, coconut leaf artists and craftsmen should be provided with facilities to work, exhibit and sell their products.

• The vast potential of using eco-friendly coconut leaves for stage decoration for marriages and other functions needs to be effectively utilised. Programmes organised by government agencies also should make use of coconut leaves/leaf craft for decorating stage and pandal.

• Currently the coconut craft items are mostly hand made. To enhance the efficiency, the possibility of utilising machines/equipments to prepare coconut leaf crafts should be explored.

• It would be ideal if organisations like fine arts academies/folklore academies institute awards to honor senior artists/ craftsmen who excell in the coconut leaf art, especially who are connected to the ritual art forms

• Difficulty to prevent wilting/loss of fresh colour of various coconut leaf based craft materials is an important problem experienced in coconut leaf craft. Hence, it is necessary to initiate research to evolve and standardize techniques for preserving coconut leaf craft materials and to enhance their storage life.

• Coconut leaf craft is to be recognised by Commissioner of Handicrafts Govt of India, in order to encourage this craft by extending identity cards to the crafts men, insurance benifits, awards etc. ■

Edible mushroom production technology using coconut residues

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Mushrooms have been used for culinary purpose from the time immemorial, not only because of its flavour and texture, but also because as it is good for health. Mushrooms are fleshy, macroscopic fruiting bodies of fungi and are technically called 'sporophores'. Though mushrooms grow on soil surface and are short-lived, their fungal mycelium grows below ground which massive and extensively spread but is also long-lived.

Thousands of species of mushrooms grow in wild, out of which some are edible, some poisonous and few are used in medicine. Some of the edible mushrooms are commercially grown and are available in markets. In India, three types of mushrooms viz. white button mushroom (Agaricus bisporus), paddy straw mushroom (Volvariella volvacea) and oyster mushroom (Pleurotus spp.) are commonly cultivated. Out of these, oyster mushroom is the ideal mushroom for tropical regions due to its ability to grow at a wide range of temperature from 15 to 31ºC. Moreover, it has high productivity and the fruiting bodies have longer shelf life, which can be easily dried and stored.

Cultivation of oyster mushroom is being done mostly using paddy straw as substrate. But at CPCRI, a low cost technology has been developed for cultivation of oyster mushroom (Pleurotus sp.) utilizing recyclable coconut wastes such as leafstalk, bunch waste, leaflets, etc. obtained from coconut gardens. Cultivation of oyster mushroom on coconut wastes involves: preparation or procurement of spawn, substrate preparation, spawning of substrate and crop management.

1. Preparation or procurement of spawn

Spawn is a pure culture of mushroom and is used as seed material for mushroom cultivation. It can either be procured from ICAR-CPCRI, Agricultural Universities or reliable private agencies or prepared in polypropylene bags. If spawns are to be prepared, sorghum, paddy, maize or wheat grains are commonly used as substrates. The grains are cooked in water for 30 minutes; excess water drained and allowed to cool by spreading over a clean surface. Calcium carbonate @ 20-30 g/kg of grain is added and mixed well. These grains are filled in polypropylene bags up to 3/4th level and the mouth of the bags are plugged with cotton and sterilized in a pressure cooker or autoclave at 1.02 kg/cm2 pressure for two hours. After cooling, they are inoculated with discs

Oyster mushroom fruiting bodies (Pleurotus sp.) grown on coconut residues

Oyster mushroom spawn

(6-8 mm diameter) of fungal growth using a sterilized cork borer or inoculation needle. The inoculated bags are incubated at room temperature for 15 to 20 days. The spawn is ready for use when grains are completely covered with white mycelial growth. The first generation fungal culture is called mother spawn, from which further spawns can be produced up to third or fourth generation. Thirty spawn bags can be prepared from a single 250g mother spawn bag.

2. Substrate preparation

Partially dried leaves and bunch waste of coconut are chopped to 5-7 cm long pieces either manually or using chaff cutter and sun dried. The chopped substrates are soaked in water overnight. Excess water is drained off the next morning. Substrates are then sterilized either by steam pasteurization in an autoclave at 1.02 kg cm2 pressure for 1½ hour or by immersing in boiling water for one hour (hot water treatment). After sterilization, excess water is drained off so that the substrate retains 70% moisture.

3. Spawning of substrate

Polythene bags of 60x45 cm size (100-150 gauge) are used for bed preparation and about 10 holes (0.5 cm dia) are made on sides and bottom for aeration. Bottom of the bag is tied with jute thread to provide flat circular bottom. 20-30 days old spawn (300 g) is taken out in a plastic tray cleaned with 1% Dettol solution (1ml in 100 ml water) and divided into three equal parts and again one portion is apportioned to four equal parts for preparing bed. Multilayered spawning technique is followed to inoculate the substrate with spawn @ 100 g per bag containing 3- 3.5 kg substrate. Sterilized rice bran is added @ 5% (150g per bag) as an organic supplement to quicken mycelial ramification.

4. Crop management

After spawning, the bags are incubated for spawn run in a mushroom house. Low cost mushroom sheds can be built within coconut gardens using coconut stem and leaves. Multi-tier racks made of coconut reapers are fixed inside the shed to place the mushroom beds. The river sand is spread on the floor upto 8 cm height. Inside of the shed is lined with gunny bags. Ventilators with

Mushroom beds after spawn run

Opened mushroom beds placed on racks in mushroom shed

Low cost mushroom shed



'Pin stage of mushroom cultivation' -- minute fruiting bodies appear on mushroom beds



Pleurotus mushroom fruiting bodies ready for harvest

insect proof plastic net should be provided on all sides of the shed for aeration. 80-85 % relative humidity is maintained inside the shed by periodical watering of the floor and gunny bags on the sides.

The filled up mushroom beds are kept on racks in the mushroom shed for 15-20 days period, during which spawn grows as white mycelium and covers the entire bed. Ideally, a temperature of 20-28^{0}C and relative humidity of about 85% are maintained in the mushroom shed. After the spawn run, the polythene covers are ripped open and the compact cylindrical beds are placed on racks 20 cm apart.

After 24 hours of removal of polythene covering, water is sprayed on the mushroom beds two or three times daily with sprayer or rose can. The first flush will be ready in 5 to 10 days after opening of the bag.

The mushrooms are to be harvested just before the up-curving of the pileus and shedding of spores. The mushrooms should be plucked in the morning before spraying water. After each harvest, about one cm deep layer of substrate is scraped and removed from the entire surface of the bed to obtain the next flush within a short period.

Three to four crops can be harvested from each bed. The interval between flushes is normally 7–10 days. Spraying the beds with a solution of 1% urea and 1% superphosphate helps to reduce interval between harvests to some extent. Wastes generated from 1 ha area of coconut garden can yield about 1700 kg of fresh mushrooms.

The spent mushroom substrate obtained after mushroom cultivation can be used to produce compost/ vermicompost for use as soil organic amendment.

Mushrooms should be packed in pin holed polypropylene bags or polythene bags and sold on the same day or stored in refrigerator (maximum 3 days). Mushrooms dried in sunlight or in hot air oven at 40-50 oC can be stored for 3-4 months. Dried mushrooms can be rehydrated by soaking in lukewarm water for 20-30 minutes. Oyster mushrooms are used for preparing various dishes like thoran, kurma, soup, pickle, etc.

Mushrooms are rich in proteins (20-30 % on dry weight basis), essential amino acids, potassium, phosphorus, and fibre but have low starch content, sodium potassium ratio and calorific value. Mushrooms are known for their natural moisture content and antioxidant properties. They are good for our skin and higher amounts of folic acid and iron found in them takes care of haemoglobin deficiency in the body. Mushrooms also contain vitamins A, B and C which bolsters immune response in our body. This makes the mushrooms 'health food' and desirable dietary component of diabetics, obesity and hypertension patients.

The cost of oyster (Pleurotus florida) mushroom production on coconut residues works out to Rs. 90/- per kg where as the market rate is somewhere between Rs. 200/- to 250/- per kg, which shows its profitability.

Mushroom cultivation can be done by farm women, unemployed youth, etc. without any additional land requirement utilizing the waste materials available in their coconut gardens. This technology can be the source of income and provide nutritional security to the family. ■

Sulphur Nutrition of Coconut

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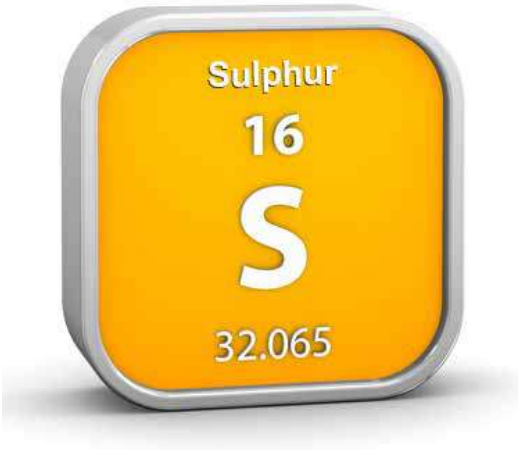

ABSTRACT

Sulphur deficiency in coconut is not reported in India even though it is increasingly reported in many other crops in India. There is every possibility of the incidence of sulphur deficiency in coconut since all the causes for the occurrence of sulphur deficiency in other crops are equally applicable to coconut also. It can be presumed that coconut palms in India suffer from sulphur deficiency and it may have been overlooked because of absence of visual symptoms.

Available information on Sulphur Nutrition of Coconut are gleaned from various literature and are compiled in this Review Article. Sulphur deficiency symptoms in coconut are illustrated guidelines for sulphur management for coconut are formulated.

The coconut palm (Cocos nucifera L) is one of the important plantation crops of India. India produces 21665 million coconuts annually from an area of 2.14 million hectares with a productivity of 10122 nuts per hectare. (2013-14). Coconut crop contributes Rs. 10,000 crores to the GDP of the country and earns Rs. 2700 crores (US $ 420 million) of valuable foreign exchange. Coconut crop provides food and livelihood security to 12 million people in India.

Since the scope for area expansion is limited, productivity improvement is the only option. There is good scope for productivity improvement in coconut. While the yield of best managed coconut gardens is 27300 nuts per hectare, the national average is 10122 nuts per hectare. The yield gap is whopping 60%. This yield gap can be bridged by improving coconut productivity, which can be accomplished by adopting best cultivation practices in general and balanced application of plant nutrients in particular.

Coconut is an exhaustive crop and it requires considerable quantity of plant nutrients for its sustainable performance.

Nutrient uptake by Coconut palm (kg)

Particulars		Nutrients					
		N	P	K	S	Ca	Mg
		(Nutrients are in elemental form)					
1.	Nutrient uptake (kg) by 150 palms, yielding 100 nuts per palm i.e. 15000 nuts per hectare.	49	7	96	4	5	8
2.	Nutrient uptake (kg) by palms producing 6.7 tons copra:						
	A) By Whole palms	174	20	250	30	70	39
	B) By Nuts only	108	15	193	9	9	15
3.	Nutrient uptake (kg) per ton of copra.	16.1	2.2	28.8	1.3	1.3	2.2

Source : IFA World Fertiliser use Manual. 1992.

Coconut farmers apply Nitrogen (N), Phosphorus (P) and Potassium (K) only. Other nutrients are taken up by the palms from the soil thereby depleting their soil reserves and causing deficiencies in soils. Such a phenomenon is now occurring with respect to sulphur, causing sulphur deficiency in soils and palms in coconut gardens.

Sulphur in plants

German Botanist Julius von Sachs had in 1860 that sulphur is an essential for the growth and development of plants. As an essential plant nutrient, sulphur has certain specific functions to perform in plants.

Some key functions of sulphur in plants

1. Protein production: Sulphur is a vital constituent of three amino acids viz cystine (27%S), cysteine (26%S) and methionine (21%S), which are the building blocks of protein.

2. Chlorophyll formation: Although not a constituent, sulphur is required for the formation of chlorophyll, the green substance in leaves and stems, which carries out photosynthesis, the primary function of green plants.

3. Biosynthesis of oils: Sulphur is known as the master nutrient for oil production in plants. Sulphur is crucial for oil yielding crops like coconut, oil palm etc.

4. Sulphur is required for biosynthesis of vital biocompounds such as vitamins (Biotin and Thiamin), glutathione, coenzyme A, sulfolipids and ferredoxin.

Sulphur is absorbed by plant roots in sulphate form (SO4). Plants generally contain 0.2-0.4% sulphur. Sulphur is relatively immobile within the plants but it is mobile in soils. Sulphur use efficiency is found to be 10%.

Sulphur as a plant nutrient is becoming increasingly important in Indian agriculture because of the increasing incidences of sulphur deficiency and crop responses to sulphur application are being reported from various parts of the country. (Shanmugam.K.S. 1995). Sulphur is now recognized as the Fourth Major Plant Nutrient along with Nitrogen (N), Phosphorus (P) and Potassium (K).

Sulphur deficiency in Coconut

Sulphur deficiency in coconut was first reported in 1959 by S.C. Baseden in Papua New Guinea. In 1960, Velasco et al described sulphur deficiency symptoms exhibited by young coconut palms, grown in sand culture by omitting sulphur. P.J. Southern investigated sulphur deficiency in coconut by conducting field experiments in Papua New Guinea. He illustrated the field symptoms of sulphur deficiency in coconut. He recommended 2 pounds (900 grams) sulphur per palm to ameliorate sulphur deficiency in coconut. (Southern P.J. 1969). Sulphur deficiency in coconut has been reported in several countries such as Pacific Islands, Comoro Islands, Mozambique, the Philippines, Indonesia and Sri Lanka.

It is a paradox that sulphur deficiency in coconut has not been reported in India where all causes of sulphur deficiency are existent and where many other crops respond to sulphur application, which confirm the prevalence of suboptimal level of available sulphur in soils. Systematic research on 'Sulphur nutrition of coconut' has not been attempted in India. Database on

sulphur nutrition of coconut is almost nil. Even sulphur uptake and removal data are not available for coconut in India.

A survey of coconut growing tracts in Kerala, conducted in 1975, indicated that sulphur content of 14th leaf of the palm ranged from 0.10 to 0.16 percent, which were below the optimum level of 0.19 percent sulphur. (Cecil, SR and Khan, HH. 1993). That survey presumably suggested the possibility of incidence of sulphur deficiency in coconut palms in Kerala, most probably the hidden hung sulphur deficiency without the visual symptoms.

Sulphur deficiency symptoms in coconut palms

Crop plants, including coconut, suffering from sulphur deficiency exhibit characteristic symptoms which are visible to naked eye. Sulphur deficiency symptoms in coconut palms are described as follows:

Coconut seedlings:

In sulphur deficient coconut seedlings, youngest leaves are worst affected. The colour of leaves varies from pale green through yellow to yellowish orange. Leaves become necrotic in severely affected seedlings and many seedlings die.

Young Coconut palms:

In sulphur deficient young palms, length of leaves which emerge after field planting is much shorter than normal, with abnormally early splitting of leaflets. Colour of leaves ranges from yellow to orange. Tips of leaflets become grey, necrosed and curled. Necrosis spreads rapidly all over the leaf, which dries out completely. Growth in young palms stops and the palms remain stunted. (Southern .P.J. 1967; Ollagnier .M and Ochs .R 1972).

Adult Coconut palms:

In sulphur deficient adult palms, chlorosis and yellowing of leaves appear first in the oldest leaves and gradually spread to other leaves in the crown. Colour of the leaves ranges from bright yellow to vivid orange. In individual leaflets, chlorosis starts from the tips, rapidly

extends until whole leaflet including midrib becomes chlorotic. Leaf size is very much reduced. Abnormal arching of leaves appears prematurely as the midrib becomes weak and pliant. There is a marked tendency of sulphur deficient palms to retain their dead leaves for more than an year. Such dead leave hang around the stem like an apron. Number of leaves in the crown is lesser than normal. Such live leaves are shorter in length and they stand in upright position. Constriction is seen in the stem diameter. Nuts are few and small in size. Nuts, particularly of button size nuts, fall prematurely. (Ohler. J.G. 1999; Southern .P.J. 1960)

Matured nuts have normal kernel thickness but on drying the kernel collapses into thin, soft, flexible and leathery copra, often brown in colour, which is usually referred to as rubbery copra, possessing poor physical and chemical qualities, particularly with a very low oil content (38% oil). This rubbery copra readily absorbs more moisture than the normal copra, leading to rapid deterioration. (Southern .P.J. 1967)

Hidden hunger of Sulphur deficiency

Hidden hunger in plants is a nutrient deficient condition, which depresses plant yield without showing visual symptoms. (Wahid .P.A. 1984). In coconut palms, Sulphur deficiency without visual symptoms occurs when the sulphur content in the 14th leaf of the palm is less than the optimum level of 0.19 percent, whereas visual symptoms of sulphur deficiency appear on the palm when the leaf sulphur content is less than the critical level of 0.13 percent. It can be presumed that coconut palms in India suffer from sulphur deficiency and it may have been overlooked because of the absence of visual symptoms.

Causes of Sulphur deficiency in India

It is now well established that sulphur deficiency is wide spread in Indian soils and crops. The following causes are attributed to sulphur deficiency in India.

Increased uptake of sulphur by crops

Uptake of all plant nutrients including sulphur by a crop is a function of its growth and yield. (Shanmugam .K.S. 1995). Average yield of coconut in India has increased from 5238 nuts per hectare in 1950-51 to 10122 nuts pet hectare in 2013-14. Increased yields of coconuts have invariably increased the uptake of sulphur from soils and depleted soil sulphur reserves considerably over the years and consequently caused sulphur deficiency in soils and palms in coconut gardens. With an area of 2.14 million hectares in India coconut crop removes annually about 8560 tonnes of sulphur from soil.

2.Use of Sulphur free fertilisers

In the early years, when Ammonium sulphate and Superphosphate were the major source of fertilisers, sulphur deficiency had not occurred in our crops as these fertilisers supplied 24% and 12% sulphur respectively as incidental nutrient to crops. With the large scale use of sulphur free fertilisers like Urea and Diammonium phosphate (DAP) incidental supply of sulphur to crops is reduced drastically thereby causing sulphur deficiency in our crops (Shanmugam.K.S. 1995)

Research conducted by S.K. Das and N.P. Datta has shown that with the continuous use of sulphur free fertilisers, the reserve sulphur status in the soil goes down and after the harvest of 6th crop, the soil reached a deficient level of available sulphur and the 7th crop started responding to sulphur application. (Das .S.K and Datta. N.P. 1973). This finding is indeed an eye opener of the imminent danger of continuous use of sulphur free fertilisers like Urea and Diammonium phosphate (DAP)

Mozambique lesson

Because of change in the fertiliser policy, coconut planters in Mozambique switched over to Urea from Ammonium sulphate. As long as planters used Ammonium sulphate (24% S) no symptom of sulphur deficiency appeared in their coconut palms. But when urea was used, leaf colour turned yellow and orange with numerous fungal lesions. (Ohler .J.G. 1999). Such a situation prevails now in India also. Because of change in our fertiliser subsidy policy, consumptions of Urea and Diammoium phosphate (DAP) have increased dramatically at the cost of Ammonium sulphate and Superphosphate thereby causing widespread sulphur deficiency in Indian soils and crops.

3. Low organic matter content of Indian soils

Soil organic matter acts as a store house of soil sulphur and about 50-90 percent of soil sulphur is found in soil organic matter. Indian soils are invariably poor in organic matter because hot tropical climate of India is not conducive for higher accumulation of organic matter in soils. Moreover continuous cultivation of crops with repeated tillage readily destroys soil organic matter by increased mineralization. Paucity of organic matter in Indian soils makes them poor in sulphur also. This is further aggravated by lack of addition of organic manures by Indian farmers. In early 1970's, 70 percent of cattle dung in India was used for manuring but it is reduced to 30% in the recent years.

4. Leaching and Erosion losses of sulphur

Because of anionic nature and high solubility, leaching losses of sulphate sulphur (SO4) are generally large, especially in coarse textured soils (Eg. Coastal soils on which coconut is predominantly grown) and in high rainfall areas (Eg. Kerala where large area is under coconut).Sulphur losses through erosion in India can be estimated at 1,30,000 tonnes annually (Tandon. HLS. 2011). Sulphur losses through leaching and erosion are some of the important causes for growing incidence of sulphur deficiency in India.

5.Multistoied mixed cropping in coconut gardens

Wide plant spacing of 7.5m x 7.5m and conducive canopy and root architecture of coconut palms permit multistoried, mixed cropping in coconut gardens. Mixed crops like banana, pineapple, cocao and pepper remove good quantity of sulphur from soil thereby aggravating sulphur deficiency in coconut gardens.

6.Higher Sulphur deficiency in Southern States

Extent of sulphur deficiency is found to be higher in the four southern states, which account for 90% of coconut area and 93% of coconut production of the country. Such a higher sulphur deficiency in the southern states can be detrimental to the coconut production of the country.

Extent of Sulphur deficiency in Southern States			
State	Percentage of soil samples in the category of		
	Low	Medium	High
Kerala	81	18	1
Tamilnadu	26	41	33
Karnataka	43	32	25
Andhra Pradesh	56	34	10
Source : Fertiliser Statistics of FAI, New Delhi 2013-14			

Soils of 'Low' and 'Medium' categories respond well to sulphur application

Diagnostic Tests for Sulphur Deficiency:

1.Soil test for Sulphur deficiency.

Soil sulphur extracted by means 0.15% CaCl2 extractant gives good correlation with sulphur uptake by plants and dry matter yield of plants. Hence this method is commonly used for estimating plant available sulphur in soils. The sulphur status of soils are categorized as follows:

Soil sulphur category	Sulphur content
Low	Less than 7.5 mg S per kg soil
Medium	7.5 – 15.0 mg S per kg soil
High	More than 15 mg S per kg soil

Soils of 'Low' and 'Medium' sulphur category respond well to sulphur application. 10-13 mg sulphur per kg soil is found to be critical for optimum plant growth.

2. Plant test for Sulphur deficiency.

Plant test (Leaf analysis) is accepted as the most reliable method of detecting nutrient deficiencies in a perennial crop like coconut. Magat et al, who studied sulphur deficiency in coconut in the Philippines, found out by means of leaf analysis that the critical level and optimum level of sulphur content of the 14th leaf of coconut palms are 13% S and 19% S respectively.

(Ohler. J.G. 1999). Sulphur deficiency occurs in coconut palms when the leaf sulphur content is below the optimum level. Optimum level of sulphur depends upon nitrogen nutrition of the palms since these two nutrients are intimately linked and are often found to be co-limiting. Nitrogen: Sulphur (N:S) ratio in coconut should be between 10:1 and 13:1. (Ohler.J.G. 1999).

3. Nut water test for sulphur deficiency.

P.J. Southern found out by his research that sulphate content of nut water was an excellent indicator of sulphur deficiency in coconut. He reported that sulphur deficiency symptoms appeared in coconut palms when the sulphate content of nut water was less than 10 ppmS. No symptom of sulphur deficiency appeared when the sulphate content was above 20 ppmS. (Southern. P.J. 1969)

Guidelines for Sulphur management for coconut.

1. Sustainable management of sulphur nutrition of coconut involves judicious blend of organic manures and mineral fertilisers. Despite low efficiency of organic manures, their inclusion in sustainable sulphur management is recommended. Results of Long Term Fertiliser Experiments (LTFE) revealed that regular, annual application of Farmyard manure (FYM) is able to maintain sulphur status in soils to guard against sulphur deficiency.

Sulphur content of some organic manures					
	Nutrient content (%)				
	Organic manure	Sul-phur	N	P_2O_5	K_2O
1.	Farmyard manure	0.13	0.50	0.30	0.50
2.	Neem cake*	1.40	5.20	1.00	1.40
3.	Mustard cake	0.68	4.50	1.80	1.40
4.	Cowpea Green manure	0.37	0.71	0.15	0.58
*Among the oil cakes, Neem cake has the highest content of 1.40 percent sulphur.					

Any one of the sulphur containing fertilisers, listed below, should be included in the fertiliser schedule for coconut. This is the most reliable and assured way of sulphur management for coconut crop.

Sulphur content of some of the fertilisers

	Name of the fertiliser	Nutrient content (%)			
		Sulphur	N	P_2O_5	K_2O
1.	Ammonium sulphate	24	20.6	0.0	0.0
2.	Superphosphate	12	0.0	16.0	0.0
3.	Ammonium phosphate sulphate	13-15	20.0	20.0	0.0
4.	Potassium sulphate	18	0.0	0.0	50.0
5.	Magnesium sulphate	12	0.0	0.0	0.0
6.	Agrl. grade mined Gypsum	13-15	0.0	0.0	0.0
7.	Phosphogypsum*	18-20	0.0	0.5 – 1.2	0.0

* Phosphogypsum is a by product from phosphate fertiliser factories. It is a high grade gypsum and is better than agricultural grade mined gypsum because of its higher purity of 90-95%, finer particle size of 100 mesh and higher sulphur content of 18-20%. Agricultural grade mined gypsum has a purity of 60-70%, particle size of 30 mesh and sulphur content of 13-15%. Phosphogypsum is preferable for sulphur nutrition of crops.

Improvement of leaf sulphur content and maintenance of leaf sulphur level at 0.20 to 0.23% in the 14th leaf of coconut palm due to regular application of sulphur containing fertilisers are observed (Cecil.S.R. and Khan.H.H. 1993).

Due to synergistic interaction between sulphur and nitrogen, combined application of sulphur and nitrogen increases the uptake and concentration of each other in coconut palm. Hence fertilisers like Ammonium sulphate and Ammonium phosphate sulphate which can supply both sulphur and nitrogen simultaneously are preferable. They also help to maintain optimum Nitrogen:Sulphur (N:S) ratio between 10:1 and 13:1 in coconut palms.

Continuous application of sulphur free fertilisers like Urea and Diammmonium phosphate (DAP) should be avoided. In the absence of application of sulphur containing fertiliser, application of phosphogypsum at the rate of 2 kg per palm per year can be done. Root feeding of 0.2% phosphogypsum (2 grams phosphogypsum per litre of water) is recommended. Application of Neem cake at the rate of 3-5 kg per palm per year and application of farmyard manure (FYM) at the rate of 30-50 kg per palm per year is recommended. Sulphur availability is reduced in poorly drained soils. Hence drainage facilities in coconut gardens should be improved. Improved drainage would improve sulphur availability in soils.

Present fertiliser recommendation for coconut crop is confined to Nitrogen (N), Phosphorus (P) and Potassium (K) only. Application of NPK only depletes sulphur reserves in soils and causes sulphur deficiency.

Declining use of sulphur containing fertilisers; increasing use of sulphur free fertilisers; increasing uptake of sulphur by crops due to increased yields; lower sulphur content of Indian soils due to their lower organic matter content and larger losses of soil sulphur through leaching and erosion are some of the important causes for sulphur deficiency in Indian soils and crops. All these causes of sulphur deficiency are equally applicable to coconut crop also. Hence there is every possibility of incidence of sulphur deficiency in coconut palms in India, most probably hidden hunger of sulphur deficiency without visual symptoms. It is high time to consider inclusion of sulphur at the rate of 300 grams per palm per year in the State level General NPK Fertiliser recommendation for coconut so as to guard against sulphur deficiency and to prevent yield decline in coconut.

Although the database on sulphur deficiency in coconut crop may be meager, the ominous signs are that sulphur deficiency is a creeping sickness of coconut crop in India. Unless appropriate action is taken, not only could sulphur deficiency become a major yield limiting factor with consequent yield decline in coconut but the efficiency of other applied major nutrients and the economics of their use will be seriously affected, apart from considerable loss of coconut production, which India cannot afford.

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Management strategies to knock down red palm weevil infesting coconut

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Coconut is a versatile and small holder crop securing the livelihood of about 12 million farm families in the country. Being synonymous to every household in Kerala, coconut forms an integral component in their cuisine. In the recent past, incidence of red palm weevil has been quite predominant, inflicting loss as high as 3-5% in certain pockets of Kerala particularly in regions prevalent with root (wilt) disease.

Reasons for red palm weevil upsurge

The reasons attributed to the recent flare up of the pest problem are

1) Unscientific upkeep of coconut palm following close spacing (less than 7.5 x 7.5 m) with palms receiving improper and inadequate light.

2) Rampant injuries caused by rhinoceros beetle feeding damage, diseases such as leaf rot and bud rot emanating volatiles orienting the adult red palm weevils for egg laying on the damaged tissues.

3) Frequent injuries by human intervention such as cutting steps for climbing and damaging palm trunk by piercing with billhook etc.

4) Cutting petiole close to the trunk and improper crown management.

5) Shallow planting and water stagnation in palm basin during monsoon season inducing root rotting.

6) Deteriorating palm health due to root (wilt) disease.

7) Inadequate knowhow about the pest by the farming community.

8) Retention of crown toppled palms in the garden encouraging weevil dissemination.

9) Unscientific way of tapping coconut inflorescence.

10) Unhygienic farm and palm management inciting weevils for egg laying.

Why farmer's panic?

When a high yielding palm in front of the house is toppled all of a sudden, the farmer feels upset. This is because many times farmers fail to identify the latent feeding damage by the pest which needs a skillful and trained eye for early detection and a close association with the palms by a farmer is found essential. Even death of one palm in every 100 palms is rated as a threshold limit in this case. Being an indigenous pest, prevalence of red palm weevil is most likely in this part of Kerala as long as the coconut palms prevail thereby ensuring biotic balance. As mosquitoes are closely associated with mankind especially in the filthy environment, so is the incidence of red palm weevil closely linked with coconut as the entire life cycle (egg. grubs, pupae and adult weevils) sustains within the palm. As mosquitoes orient towards unhygienic situation, adult red palm weevils are mostly oriented towards injuries encountered on the palm. A trained eye for early detection and simple

Injury on palm trunk

Retention of crown toppled palms

Weevils surviving on collapsed crown

Crown entry

Leaf axil entry

Bole entry

avoidance of palm injuries insulates pest avoidance in the garden.

Modes of entry

Three modes of entry of red palm weevil are documented hereunder

No.	Entry mode	Linking factors / Pre-disposing factors
1	Crown entry	Damage by rhinoceros beetle, lightning and diseases such as leaf rot and bud rod. Palms with root (wilt) disease and deteriorating health.
2	Leaf axil entry	Dislocation of bunches due to heavy bearing particularly in dwarf genotypes and hybrids. Cutting petiole close to trunk and damage/injuries to leaves during harvesting operations
3	Bole entry	Shallow planting, planting in ill-drained soils, injury by tractor drawn farm implements

In a recent survey undertaken by ICAR-CPCRI scientists at Pollachi, Coimbatore District, Tamil Nadu, it was observed that palms with root (wilt) disease encountered higher incidence of red palm weevil (>5%) damage in comparison to healthy coconut palms (<0.25%). This is a clear indication of health deterioration in diseased palms well diagnosed by the weevil to hasten up the decomposition process during the course of feeding.

How to sensitize?

Farmers need not be panic as long as he understands the early diagnostic symptoms of red palm weevil infestation. This skill cannot be acquired all of a sudden but a routine and systematic inspection of crown, leaf axils and bole region of palm systematically could expose a farmer to understand the symptoms in advance. This routine inspection has failed in the coconut production system leading to the flare up of the pest and farmers are hereby advised to diagnose the following symptoms in advance

- Splitting of petiole at the base of trunk due to pest entry and subsequent feeding
- Abnormal un-gripping of leaf petiole from the trunk surrounding the base of the bunch
- Abrupt yellowing of leaves around mid-whorl region
- Choking and drying of spear leaf region
- Presence of bore holes and oozing fluid from the trunk
- Gnawing sound of grubs when heard through the trunk
- Injury/ damage in juvenile palms as the weevils prefer dwarf and juvenile palms aged 5-15 years for egg laying.

Though the crown collapse appears all of a sudden the feeding grubs would have fed for a period not less than 60 days in more than 50 numbers to kill the palm possessing a single apical meristem. There has been enhanced preference among farmers for planting dwarf genotypes for early bearing as well as disease resistance. When dwarf palms are planted on a large scale, they are relatively more susceptible to red palm weevil attack than the tall genotypes. It doesn't mean dwarfs are not preferred, but dwarfs need more systematic care for field establishment and early bearing.

Sachets containing chlorantraniliprole

Botanical cake developed by ICAR-CPCRI

Petiole splitting

Presence of bore holes

Oozing of brownish fluid

Approaches for red palm weevil management

Cultural

a) Close scrutiny and regular inspection of palms at all vulnerable points of entry (Crown, leaf axil and bole region) for early diagnosis. Early morning time can be best utilized for scouting.

b) Haphazard planting of coconut anywhere within the garden is not advisable. Planting coconut with correct spacing (Tall 8 x 8 m; Dwarfs 7x7 m) and proper light is very critical for adequate growth and pest repulsion. Never plant seedlings beneath big trees. Closer spacing infuses more volatile cues favouring the pest orientation.

c) Avoid physical injuries on palms and always cut petiole 1.2 m away from trunk. Palm and farm hygiene are very important practices for pest avoidance.

d) Constant vigil and prophylactic treatment for rhinoceros beetle damage, leaf rot and bud rot diseases are preferable.

Ecological

A pest suppressive coconut-based agro-ecosystem could be designed through ecological infrastructure within the cropping system such as defenders, volatile cue repulsion, refuge site, predatory birds etc. Such crop-habitat diversification approach could avoid pest entry into the system through stimulo-deterrent diversionary strategy. Growing intercrops such as nut meg, rambuttan, curry leaf, papaya, banana etc distracts weevils from egg laying in coconut due to volatile confusion in host location.

Crop-habitat diversification technique

Botanical/Chemical

Prophylactic leaf axil filling with 250 g neem cake/ maroti cake / pongamia cake along with equal volume of sand and placement of two naphthalene balls on top-most two leaf axils repelled rhinoceros beetle. In addition, placement of two perforated sachets containing chlorantraniliprole (3 g) or fipronil (3 g) or botanical cake developed by ICAR-CPCRI was found effective during monsoon phase.

Spot application of imidacloprid 0.02% (1ml per litre) or indoxacarb 0.04% (2.5 ml per litre) was found effective in pest suppression on infested palms and the growing point recovered swiftly. Residue of imidacloprid was not detectable in nut water and nut meat up to 30 days.

Biological

Prophylactic delivery of filter paper sachets containing 10 Heterorhabditis indica-infected Galleria mellonella cadavers in combination with botanical cake on the leaf axils could reduce 35-85 % rhinoceros beetle attack and shielded palms from red palm weevil invasion during monsoon period.

Semiochemicals

Pheromone traps @ 1 trap / ha could catch more weevils when installed in community mode under strict precautionary measure and should not be attempted by individual farmer. Care should be taken for timely servicing of food baits and traps are to be placed at the corners of the field preferably on separate poles. In Kerala conditions, where palms of different age groups are available within a homestead, it can be avoided. However, in plantations of uniform age, it can be recommended as a component of IPM but never advised as a sole mode of management. Palms adjacent to the pheromone traps need to be meticulously monitored for pest attack.

Knowing the symptoms keenly, adoption of cultural techniques systematically and intervention using prophylactic as well as timely curative measures would reduce the incidence of red pal weevil. ■

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The 47th APCC COCOTECH meeting held

The 47th APCC COCOTECH of the Asian and Pacific Coconut Community (APCC) was held during 26-30 September 2016 at Bali, Indonesia. The theme of the Conference was Innovations that Promote Inclusive Growth and Sustainability of the Coconut Sector. The meeting was jointly hosted by the Government of Indonesia through the Ministry of Trade and APCC. An Exhibition on coconut was also organised as part of the 47th COCOTECH to showcase the various value added products from coconut in which 28 firms from various countries including India, Indonesia, Malaysia, Philippines and Thailand participated.

The Conference consisted of ten technical sessions on various topics related to policies, programs, production, processing, nutrition, health, trade, markets, quality standards, pest and disease etc. Meetings of strategic importance on establishment of a proposed forum on Coconut Tissue Culture, establishment of an International Network for Integrated Pest management (IPM) in coconut, collaboration on clinical studies into the nutrition and health benefits of coconut, meeting of the country representatives of COGENT in relation to the future of the program and the status of the International Coconut Gene Banks were held alongwith the Conference.

Dr. A K Singh, Chairman, Coconut Development Board, Government of India representing the Government of India in the meeting

Dr. A K Singh, Chairman, Coconut Development Board, Government of India attended the meeting and chaired the second part of the session on advancement in technologies and studies for proactive responses to future threats.

The session on Product Development for Growing and Emerging Markets focused on product diversifications for niche markets, global market trends for coconut beverages, coconut product utilization, the prospects and opportunities of coconut biofuel and innovative coconut processing technology.

Mr. Vinod Kumar, Chief Executive Officer, Palakkad Coconut Producer Company Limited, Kerala, India shared his experiences in the session on product diversification through Farmer Producer Organisations through his presentation on the Scope of Farmer Producer Companies – Beyond Conventional Wisdom. Dr. M. Vijayakumar, Fellow, Thoracic Centre, Rotterdam & Professor and Interventional Cardiologist, Amrita Institute of Medical Sciences, India made a presentation on dietary coconut oil and cardiovascular health and spoke on the results of the recently published study of coconut oil versus sunflower oil on cardiovascular risk factors in patients with stable coronary heart disease.

The session on Technological Advancements in Rapid Multiplication, Varietal Improvement and Production of Planting Material focussed on discussions

Participants of 47th Cocotech meeting

and deliberations on the technological advancements for rapid multiplication through tissue culture and varietal improvement in coconut. In the session Mr. David J. Lobo, Chairman & Managing Director, Deejay Farms, Bangalore, India spoke on Potential for Commercial Production of Elite Planting Material and Mr. Raam Mohan, Chief Executive Officer, Umapathy Farms, India shared his experiences of Umapathy Coconut Hybrid Centre,India. In the session on Interaction with Equipment manufacturers Mr. Suresh Kumar, General Manager, Business Development, T&I Global Ltd, India made a presentation on the Complete Solution to Coconut Processing and Mr. Rajarathinam, Proprietor, Essar Engineers, India spoke on Technologies and machinery for coconut meat, water, shell and husk processing

The Conference was attended by 380 participants from 30 different countries that included Plenipotentiary Delegates of the APCC Member countries, senior government officials and dignitories, invited resource speakers and presenters from the private sector, scientists, researchers, farmer groups and producer organizations, manufacturers, exporters and importers of coconut products and other stakeholders in coconut sector. The Associate Minister of Agriculture and Fisheries of the Government of Samoa, Hon. Faasootauloa Pati Taulapapa attended the programme. Hon. Commodore (Retd.) Peter Ilau, DMS, CBE, Ambassador, Embassy of Papua New Guinea in Jakarta, Indonesia and the Hon. Ratu Seremia Tuinausori Cavuilati, Ambassador, Embassy of the Republic of Fiji in Jakarta, Indonesia attended the inaugural session.

The Session in progress

The partner organisations that participated in the Conference included Pacific Community (SPC), International Pepper Community (IPC), Centre de Coopération Internationale en Recherche Agronomique Pour le Développement (CIRAD), International Coconut Genetic Resources Network (COGENT), Coconut Development Board (CDB) of India, Indonesian Palm Crops Research Institute (ICOPRI), Philippine Coconut Authority (PCA), Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), Coconut Development Authority (CDA) of Sri Lanka, Coconut Research Institute (CRI) of Sri Lanka, Coconut Cultivation Board (CCB) of Sri Lanka, Centre National de Recherche Agronomique (CNRA) of Cote d'Ivoire, Centre de Investigaci'on Cienti'fica de yucat'an (CICY) of Mexico, Mikocheni Agricultural Research Institute (MARI) of Tanzania, Centre for Agriculture and Bioscience International (CABI) in Malaysia, United Coconut Association of the Philippines (UCAP) and Conservation and Development of Coconut Oil Forum of Thailand (CDCOT). Participants from the non APCC member countries viz. Australia, China, Cote d'Ivoire, France, Japan, Madagascar, Mexico, Singapore, Sweden, Tanzania, United Kingdom and the United States of America also took part in the programme.

The policy recommendations for adoption/ implementation of the 47th Cocotech by APCC Member Countries are the following. National Governments may extend policy and program support for strict adherence to quality standards by processors of coconut products to enable the global coconut community to develop and sustain the expanding global markets. National Governments may take up with relevant authorities for the creation of separate Harmonised Codes (HS) for virgin coconut oil, coconut water, coconut sugar and other products of importance that

are increasingly entering the markets and they may include coconut development as a high priority program in its national development plans and provide adequate funding and resources to implement each year. National Government may review and develop viable strategies and policies for the improvement of farmer organisations that would enable and empower farmers to access government sponsored incentives for development and to benefit from economies of scale pertaining to market accessibility. APCC Member Countries may inform the priority disease areas in their respective countries and the APCC Secretariat for consideration by the APCC Scientific Advisory Committee on Health within the framework of collaboration in the clinical studies project. ■

Shri Vinod Kumar, Chairman, PCPCL with Shri. Uron M Salum, Executive Director, APCC

Coconut Development Board invites Projects for financial assistance

Coconut Development Board (CDB) is extending financial support for setting up/expansion/modernization of coconut based industries. The scheme is being implemented on project basis. Financial support is extended to the tune of 25% of the project cost limited to Rs.50 lakhs per project as back ended subsidy. Prospective entrepreneurs/ NGOs/ Co-operatives/ FPOs can avail the benefits of this scheme for setting up coconut industries/ units for production of coconut based value added products like desiccated coconut powder, virgin coconut oil, spray dried coconut milk, coconut milk, flavored coconut juice, tender coconut water, coconut shell based activated carbon, shell powder and shell charcoal.Interested entrepreneurs planning to set up coconut based processing units with a processing capacity of 5000 coconuts per day and above may contact : *Shri. S.S Choyal, Deputy Director, Mridula K, Technical Officer or Jyothi K Nair- Food Processing Engineer. For more details, visit: www.coconutboard.gov.in. Phone No. 0484-2376265 / 2377266 / 2377267 / 2376553*

Dr. G R Singh retired

Dr. G R Singh, Chief Coconut Development Officer (CCDO) retired on superannuation on 30th September 2016. He has been holding the post of CCDO since 27th May 2016. Dr. G R Singh is a postgraduate in Agriculture and a Ph.D holder in Globalization of Coconut Industries and Coconut Farmers in North East Region and its evaluation from Sido Kanhu Murmu University, Dumka,Jharkhand. Dr. Singh started his official career in the Ministry of Agriculture, Department of Animal Husbandry in 1980. He joined the Coconut Development Board in August 1985 and subsequently served at various offices of the Board in Assam, Karnataka, Bihar and Maharashtra. As Director of the Board, he was in charge of various states like Gujarat, Madhya Pradesh, Jharkhand, Chhattisgarh and Bihar. Prior to his appointment as CCDO, Dr. G R Singh was serving as the Director at the Market Development cum Information Centre of the Board at New Delhi.

National Meet on Prospects of Coconut Sector and Kisan Mela-2106

Shri Radha Mohan Singh, Hon'ble Union Minister of Agriculture and Farmers' Welfare, Govt. of India inaugurated the National Meet on Prospects of Coconut Sector and Kisan Mela-2106 organized by Central Plantation Crops Research Institute at the Regional Station, Kayamkulam, Kerala during 29-30 September, 2016. The programme was organized as part of the celebrations of 100 years of coconut research dating back to 1916.

Shri Radha Mohan Singh in his inaugural address complimented the research achievements made by ICAR-CPCRI to make coconut sector more vibrant during the 100 years of research. He opined that low productivity and high labour wages are some of the problems presently faced by the coconut farmers, and therefore, 'comprehensive coconut care' should be the focus for sustaining income.

Hon'ble Minster further spoke on the need for maintenance of soil health which is considered as the backbone of agriculture and informed that the Govt. of India is taking necessary steps to distribute soil health cards to all farmers in the country by 2017-18. For this purpose, the union government is planning to set up soil testing laboratories in each panchayath in the country with necessary financial support.

The Minister further informed that the government will give priority to the lab-to-land programme for transfer of technology to farmers. The Central Government would take initiatives to ensure that the new technologies and research results evolved in agricultural research stations and universities in the country reach the farmers at his doorstep when he needs it most. He called upon for the production of quality planting materials and judicious use of water for enhancing productivity and urged the researchers and farmers to focus on crop pluralization and product diversification for sustained income and better profitability of farming.

Shri Radha Mohan Singh inaugurating the National meet. Seen are Shri. Raju Narayana Swami IAS, APC, Kerala and member of CDB Shri. K.C Venugopal, M.P, Alappuzha, Dr. P. Chowdappa, Director, CPCRI and Shri. V.S Sunil Kumar, Minister of Agriculture, Kerala

The Minister launched 'e-Kalpa', a mobile app, for quick retrieval of ICAR-CPCRI technologies and user-friendly farm-problem diagnosis and remedial measures, and two value-added products under the brand,' Kalpa krunch' and 'Kalpa sugar'. These value-added products from neera can further enhance the viability and profitability of the neera industry, directly benefitting all the stakeholders in the value-chain. He also released a book on 'Production of Quality Planting Material". A national level exhibition organized as part of the National Meet was inaugurated by the Minister wherein ICAR institutes, KVKs, Coconut Development Board, Kerala Agricultural University, FACT, State Department of Agriculture and private entrepreneurs displayed latest technologies and value-added products.

Shri. V.S. Sunil Kumar, Hon'ble Minister of Agriculture, Govt. of Kerala, in his keynote address, urged to consider coconut as a sensitive commodity and requested the Central government to take the state government in to confidence, while formulating export - import policies with far-reaching consequences for farmers in the state. He called for synergized research between central and state research organizations keeping 'Farmer First'. He informed the government's plan for establishing a chain of agro-parks to produce value-added products from agricultural produces in all districts of Kerala, of which four would be coconut-based parks. The state Minister also released a book Compendium of Phytophthora Diseases and a Souvenir Gleanings of Coconut.

Shri. K.C. Venugopal, Hon'ble Member of Parliament, Alappuzha presided over the function. Dr. P. Chowdappa, Director, ICAR-CPCRI, Kasaragod welcomed the gathering and Dr. V. Krishnakumar, Head, ICAR-CPCRI, Regional Station proposed vote of thanks. Shri Raju Narayana Swamy, IAS, Agricultural Production Commissioner & Principal Secretary (Agriculture),

Shri Radha Mohan Singh planting coconut seeedling in the CPCRI premises

Shri. Biju Prabhakar IAS, Director of Agriculture, Govt. of Kerala and Shri. C.R. Muraleedharan, Member, Coconut Development Board attended the progarmme.

More than 3,500 farmers and delegates attended the meeting. Various central and state government agencies like ICAR institutes and Krishi Vigyan Kendras in the state; Coconut Development Board; NABARD; Kerala Agricultural University; Department of Agriculture, Kerala; ATMA; Coconut Producers' Companies and Federations and various private entrepreneurs and input agencies were partners of the two- days programme.

An interactive session on prospects of coconut sector was held as part of the programme wherein experts spoke on value addition in coconut, production strategies and pest management strategies in coconut. ■

Shri Radha Mohan Singh in CDB stall

Virgin Coconut Oil based Ayurvedic Hair Oil and Shampoo launched

M/s Pranathmaka Ayurvedics Pvt Ltd, Kerala launched two new coconut based products in the market Samskriti Ayurvedic Hair Care Oil and Samskriti Aindrika Ayurvedic Shampoo. M/s Pranathmaka hold years of extensive knowledge and practical solutions and experience in the Ayurvedic Sector supported by research and development team. M/s Pranathmaka use pure virgin coconut oil prepared in their own plant using cold process technology transferred by CDB for developing the ayurvedic hair care oil under the brand name 'Samskriti'. CDB has approved the project for setting up of Virgin Coconut Oil with a total project cost of Rs.198.25 lakhs in its 43rd Project Approval Committee (PAC) and has released Rs. 28.09 lakhs as subsidy to M/s Pranathmaka Ayurvedics Pvt Ltd. The company is planning to introduce Samskriti Mayukha Baby Oil, Samskriti Gandhapushpa Fairness Face Pack and Samkriti Virgin Coconut Oil very soon. The company is certified under Good manufacturing Practice (GMP), Food Safety and Standard Authority of India (FSSAI) and ISO 22000:2005. For further details contact: Prince P. Sathyan – 9061520003, Siva Sudheesh N – 7736696020.

Workshop on Coconut Based Business Ventures

With an objective to promote development of business models most appropriate to the newly established Coconut Producer Companies and to equip them for identifying ventures, risks and to formulate marketing strategies, Central Plantation Crops Research Institute, Kasaragod in association with Coconut Development Board, Kochi organized a workshop on coconut based business ventures at CPCRI, Kasargod during 9th -10th September 2016.

Dr. H.P. Singh, former DDG (Hort. Sci.), ICAR and former Chairman, Coconut Development Board was the Chief Guest. Dr. P. Chowdappa, Director, CPCRI, delivered the presidential address. Dr. K. Muralidharan, Principal Scientist, CPCRI, Kasaragod welcomed the gathering.

Dr. H.P. Singh, in his inaugural address said that the most significant challenge as of now is to turn the small holdings into commercially viable units. The coconut farmers should be able to capture the changing market trends and accordingly change their production and marketing activities. According to him, the high quality products from coconut sector like virgin coconut oil (VCO) and neera should be positioned appropriately in the consumer mind. He also emphasized the imperativeness of formation of national consortium and development of common brand for coconut products.

Dr. Chowdappa in his presidential address emphasized the significance of positioning coconut as a nutraceutical food through effective value addition technologies. He highlighted the crucial role of Coconut Producer Companies (CPCs) in commercializing the value added technologies of coconut. He said, that 65 CPCs established in India at present are in the nascent stage and in dire need of business facilitation and support. He also laid emphasis on the importance of elevating the value addition activities in coconut sector from current level of six percent to at least 25 percent, in order to ensure better prices, and also to become competitive in the international front. In this regard, CPCRI has already joined hands with Arecanut and Cocoa Marketing and Processing Co-operative Limited (CAMPCO) and launched coconut sugar based 'Kalpa bar dark chocolate' and 'Kalpa drinking chocolate'

Members of Coconut Producer Companies took part in the programme. There were three technical sessions and a business-to-business meet besides the inaugural and valedictory sessions. Presentation of the short-listed business plans submitted by CPCs for the Dream Big Kalpa Business Plan Competition was held in one of the technical sessions of the Workshop. 170 delegates including 20 scientists from CPCRI. 45 CPCs from the four southern states viz., Kerala, Tamil Nadu, Karnataka and Andhra Pradesh took part in the programme. The workshop recommended that In order to enter the international market of coconut value added products, there is an urgent need to scale up the production in compliance with the international food safety standards. It was also recommended that social media may be used to the maximum extent possible for better communication and interaction among CPCs

Agri-Horti entrepreneurship development meet

Dr. A.K Singh, Chairman, CDB addressing the Agri-Horti Entrepreneurship Development meet

Ministry of Agriculture and Farmers Welfare, Government of India conducted an exhibition as part of the Agri-Horti Entrepreneurship Development meet in North East Region during 19th & 20th October 2016 at NEDFi Convention Centre, Guwahati. Various government departments of North East Region took part in the exhibition and displayed food products and other items. Coconut Development Board, Regional Office, Guwahati participated in the exhibition and displayed coconut products like virgin coconut oil, coconut mouth freshner, coconut neera, coconut chips, dessicated powder etc. M/s Keratech Pvt. Ltd also participated in the exhibition and displayed their products.

Coconut Development Board, Regional Office, Guwahati conducted Agri-Horti Entrepreneurship Development meet in North Eastern Region on coconut on 19th October 2016 at the Conference hall of NEDFi. Dr. A.K. Singh, Chairman, Coconut Development Board chaired the programme. President, Secretary and members of Coconut Producers Societies from Assam and Nagaland attended the programme. Coconut based entreprenuers Shri K.V. Mohan, Keratech Pvt. Ltd, Trissur, Kerala, Smt. Malamoni Hazarika, Kamdhenu Products, Guwahati, and Smt. Amrit Madhuri Devi, Madhur Products, Tezpur, Sonitpur District, Assam attended the programme. Shri Lunghar Obed, Director, Coconut Development Board, Regional Office, Guwahati delivered the welcome address. Chairman, CDB, in his key note address suggested that the Area Expansion Scheme should be implemented in a broader way in Assam and Northeast. Shri Sreekumar Poduval, Processing Engineer, CDB, Regional Office, Guwahati made a presentation on the Scope & Potential of Coconut Industry in North East Region.

Shri S.K. Patnaik, IAS, Secretary to Govt. of India, Department of Agriculture, Shri Ram Muivah, IAS, Secretary, North Eastern Council and Shri Naveen Verma, IAS, Secretary to the Govt. Of India, Department of DONER visited stall of Coconut Development Board.

A view of the Board's stall

Annapoorna World of Food India

Shri.Sadabhau Khot, Hon'ble State Agriculture Minister, Govt. of Maharashtra in Board's Stall

A view of Board's stall

Coconut Development Board, State Centre, Thane, Maharashtra participated in Annapoorna World of food India from 22nd - 24th September 2016 at Bombay Exhibition Centre, Mumbai, Maharashtra. The exhibition was organised by Federation of Indian Chambers of Commerce and Industry (FICCI), New Delhi. Coconut Development Board State Centre, Thane also organized a B2C meet along with the exhibition.

Coconut Development Board displayed various value added coconut products like packed tender coconut water, coconut oil, coconut milk powder, virgin coconut oil and well informative charts and posters Board's publications, leaflets and brochures on the schemes and products in the stall. M/s. Keratech (P) Ltd. Kerala, M/s. Adivasi Food Product Pvt. Ltd., M/s. Thirukochi Coconut Producer Company Ltd., Ernakulam, M/s.Holista Tranzworld Private Limited, M/s.MSC Packaging, and M/s. Shriram Coconut Products Ltd. had their sales cum display counters in the Board's stall.

Apart from providing a great platform for business meetings, the exhibition had the presence of international and local expertise which created the biggest professional platform for the Indian subcontinents food drink and hospitality sectors. Over 150 exhibitors took part in the fair.

Shri.Sadabhau Ramchnadra Khot, Hon'ble State Agriculture Minister, Govt. of Maharashtra visited Board's stall and enquired about various value added products of coconut. More than fifty thousand visitors including officials of various national and international companies and business communities visited the exhibition.

Coconut oil keeps the brain healthy

Perhaps you've heard of all the amazing benefits of coconut oil for improving your overall health. But did you know that it also has numerous benefits that support coconut oil as a way to promote brain health and cognitive functioning?

Coconut oil consists of Medium Chain Triglycerides (MCTs), which serve as a secondary source of energy for the brain. The brain's primary source of energy is glucose. However, in diet that's high in saturated fat and sugar, the brain can become insulin resistant and glucose cannot reach the cells to provide fuel needed for the brain. Ketones, which are a byproduct of the breakdown of MCTs in coconut oil can provide the brain with instant energy without the assistance of insulin. Also known as the "healthy fats", recent evidence suggests that the consumption of MCTs found in coconut oil has numerous benefits may prevent Alzheimer's, improve memory and increase cognitive functioning. Source: http://www.dailytech.com

Indian Coconut products export recorded 33.69% growth

K.S. Sebastian, Assistant Director, Export Promotion, CDB.

Export of coconut products during the first six months of the financial year 2016-17 touched Rs. 944.41 crores recording a growth of 33.69% compared to the export during the corresponding period of the previous year. Significant increase was recorded in the export of desiccated coconut, coconut oil, fresh coconut, copra and coconut shell charcoal. Export of coconut products from India during the first six months of the financial year 2016-17 is given in table 1.

Table1

Export of coconut products from India during April to September 2016

		September 2015		September 2016		2015 (April to September)		2016 (April to September)	
		Qty (in MT)	Value (Rs. In lakhs)	Qty (in MT)	Value (Rs. In lakhs)	Cum. Qty (in MT)	Cum. Value (Rs. In lakhs)	Cum. Qty (in MT)	Cum.Value (Rs. In lakhs)
1	Activated Carbon	4685.36	4877.68	6335.46	6158.06	31810.21	33391.45	33777.32	34117.36
2	Coconut Oil	720.06	1629.97	4480.86	4549.33	3717.69	8555.30	16282.29	17125.05
3	Fresh coconut	2985.42	1235.01	7443.32	1886.31	16387.45	6267.34	39348.48	9551.33
4	Desiccated Coconut	132.72	174.05	1069.61	1086.39	1185.41	1754.59	7755.63	7806.55
5	Copra	201.04	211.64	2445.00	1609.66	1643.43	1485.11	11177.61	7330.33
6	Dry coconut	816.47	959.67	568.48	441.22	8516.64	8934.65	5785.52	5476.82
7	Shell charcoal	697.27	224.26	3355.00	799.11	3786.56	1278.15	12271.32	3101.49
8	Grated/sliced coconut	123.91	304.20	71.08	179.73	982.19	2002.00	897.10	1648.66
9	Coconut Fatty Soap		246.80		311.84	0.00	1494.64		1633.78
10	Coconut Hair Oil				193.47	0.00	0.00		1153.82
11	Virgin Coconut Oil	59.82	191.80	13.52	43.88	490.58	1664.84	232.38	773.85
12	Oval coconut shell		70.22		73.60		463.62		647.27
13	Hair Cream		92.27		73.28	0.00	523.13		263.46
14	Coconut Water	79.40	131.00		35.00	79.40	371.77		243.01
15	Misc coconut products		331.21		451.75		2454.28		3568.62
	Total		10679.79		17892.63		70640.89		94441.39

Activated Carbon

The export of activated carbon from India during April to September 2016 was 33,777.32 MT. United States was the leading importer of Indian Activated Carbon, followed by United Kingdom. Details of export of Activated Carbon from India during April to September 2016 is given in table 2

Country wise export of Activated Carbon during April to September 2016

Sl. No.	Country	Qty (in MT)	Value (Rs in lakhs)
1	United States	7312.42	7483.89
2	United Kingdom	2558.87	2534.44
3	South Korea	2234.29	2510.88
4	Germany	1911.35	1931.18
5	Sri Lanka	1765.48	1537.32
6	Russia	1662.54	1660.51
7	Netherlands	1482.66	1502.72
8	Turkey	1374.83	1109.34
9	Canada	1120.12	1124.98
10	Belgium	1100.41	1031.54

11	Estonia	826.00	816.14
12	South Africa	786.40	788.78
13	China	771.42	1059.59
14	Italy	683.60	569.83
15	Philippines	607.51	618.01
16	France	567.80	619.09
17	Japan	554.92	738.15
18	Tanzania	519.40	557.77
19	Ghana	514.00	591.01
20	Peru	484.80	425.76
21	Taiwan	467.90	435.20
22	Thailand	431.94	438.17
23	Latvia	300.00	299.41
24	Australia	271.00	270.92
25	Finland	229.80	153.18
26	Surinam	220.00	225.92
27	Senegal	202.40	224.73
28	Others	2815.46	2858.90
	Total	33777.32	34117.36

(quantity in %)

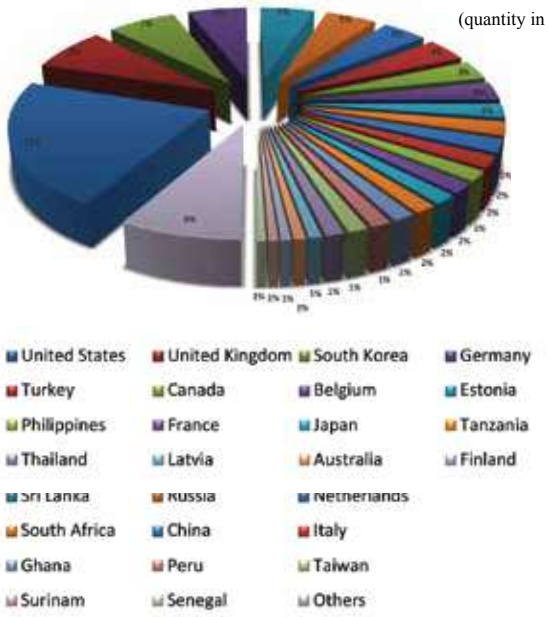


Table 2

Coconut Oil

Export of coconut oil from India during the first six months of the financial year 2016-17 was 16282.29 MT, which was 338% higher compared to 3717.69 MT recorded during the corresponding period of last year.

Malaysia, Indonesia, UAE, Srilanka, Saudi Arabia and Myanmar are the major countries exporting coconut oil from India. Export of coconut oil from India during the month of April to September 2016 is given in table 3.

Export of coconut oil during April to September 2016		
Country	Qty (in MT)	Value (Rs in lakhs)
Malaysia	6988.26	6374.37
Indonesia	3428.86	3042.27
United Arab Emirates	1366.81	1712.34
Sri Lanka	584.99	607.19
Saudi Arabia	537.07	694.00
Myanmar	536.98	664.56
Oman	293.25	353.12
Pakistan	289.69	462.80
United States	218.89	520.97
Qatar	217.80	318.78
Kuwait	168.97	214.90
Bahrain	116.56	152.08
Nepal	99.21	127.31
United Kingdom	93.52	186.93
Brazil	84.00	156.89
Taiwan	77.70	91.38
Others	1179.73	1445.17
Total	16282.29	17125.05

(quantity in %)

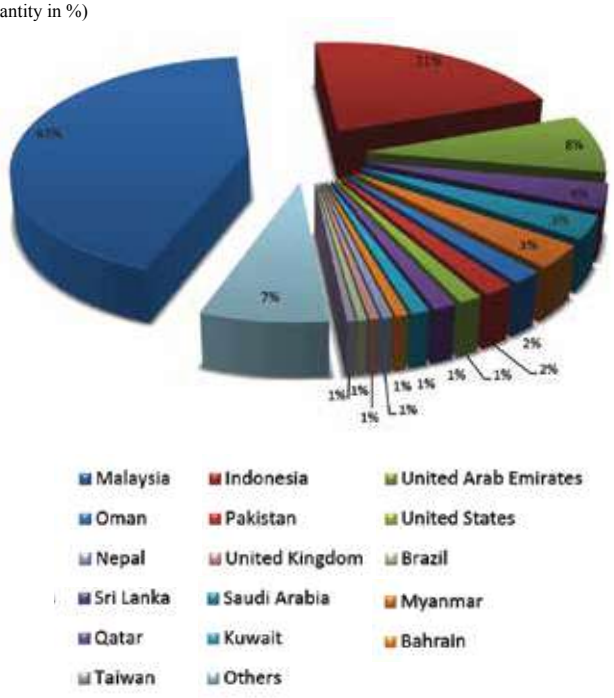


Table 3

Desiccated Coconut : Export of desiccated coconut powder during the first six months of the financial year 2016-17 was 7755.63 MT which was 554.26 % more than the desiccated coconut export during the corresponding period of last year. Export of desiccated coconut during the corresponding period of the previous year was 1185.41 MT. Country wise export of desiccated coconut powder during the period April to September 2016 is given in table 4.

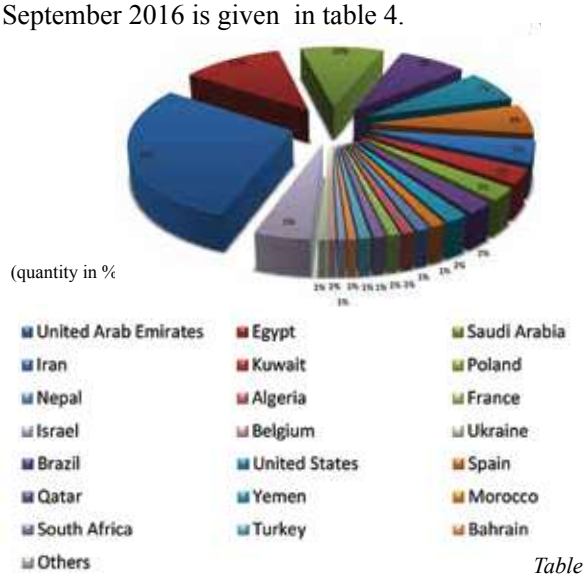


Table 4

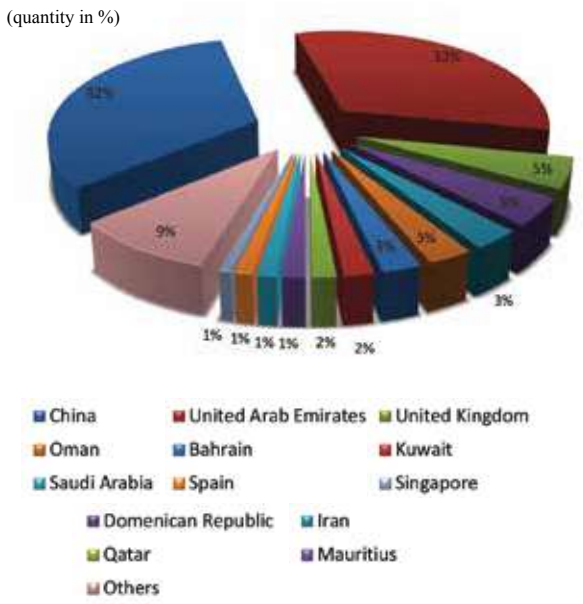
Export of DC from India during April to September 2016		
Country	Qty(in MT)	Value(Rs in lakhs)
United Arab Emirates	2224.91	2207.40
Egypt	921.00	900.34
Saudi Arabia	766.16	784.90
Brazil	620.00	664.43
United States	530.11	521.90
Spain	483.00	476.15
Iran	366.00	353.88
Kuwait	251.45	267.00
Poland	212.00	213.32
Qatar	185.37	197.85
Yemen	151.42	149.16
Morocco	89.00	90.70
Nepal	86.34	94.50
Algeria	77.00	75.79
France	77.00	86.28
South Africa	76.00	76.52
Turkey	75.00	60.03
Bahrain	52.59	59.73
Israel	51.00	54.50
Belgium	50.00	53.99
Ukraine	48.00	51.51
Others	362.29	366.67
Total	7755.63	7806.55

Fresh Coconut

Export of dehusked coconut from India during the period April to September 2016 was 39348.48 MT. Export of fresh coconut during the corresponding period of last year was only 16387.45 MT.Countrywise export of fresh coconut from India during this period is given in table 5.

Export of fresh coconut during April to September 2016		
Country	Quantity (in MT)	Value (Rs in lakhs)
China	12693.74	2461.98
United Arab Emirates	12594.77	3446.10
United Kingdom	2001.06	689.21
Dominican Republic	1801.64	428.85
Iran	1244.78	368.96
Oman	1157.18	369.04
Bahrain	993.98	278.78
Kuwait	756.68	236.36
Qatar	614.51	217.07
Mauritius	579.68	164.11
Saudi Arabia	476.23	208.78
Spain	448.95	209.57
Singapore	302.35	65.98
Others	3682.94	406.54
Total	39348.48	9551.33

Table 5



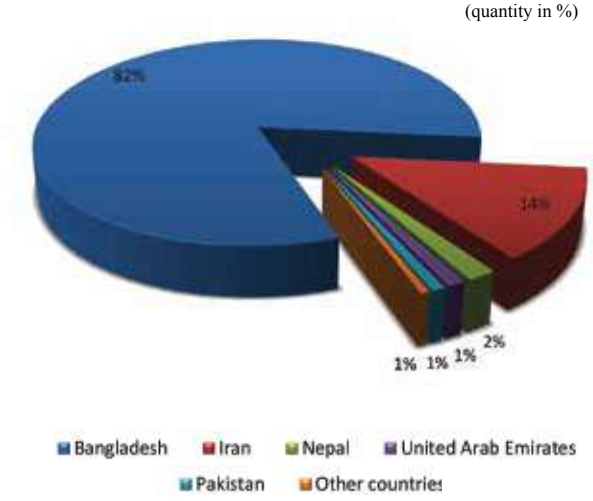
Copra

Export of copra from India from April to September 2016 was 11177.61 MT against export of 1643.43 MT recorded during the corresponding period of previous year. Countrywise export of copra from India during the period is given in table 6.

Export of Copra during April to September 2016		
Country	Quantity (in MT)	Value (Rs in lakhs)
Bangladesh	9177.32	6006.28
Iran	1517.05	948.56
Nepal	201.38	164.00
United Arab Emirates	125.00	79.64
Pakistan	94.00	57.06
Other countries	62.87	74.79
Total	11177.61	7330.33

Table 6

(quantity in %)



Coconut Shell Charcoal

Export of coconut shell charcoal from India during the first six months of the financial year 2016-17 was 12,271.31 MT which is 224.08% higher than the export during the corresponding period of the previous year. The export of coconut shell charcoal during the corresponding period of the previous year was 3786.56 MT only. Since the domestic price of coconut shell charcoal is very competitive and the product is covered under Merchandise Export Incentive Scheme (MEIS), the export is expected to increase in the coming months also. Countrywise export of coconut shell charcoal during the period is given in table 7.

(quantity in %)

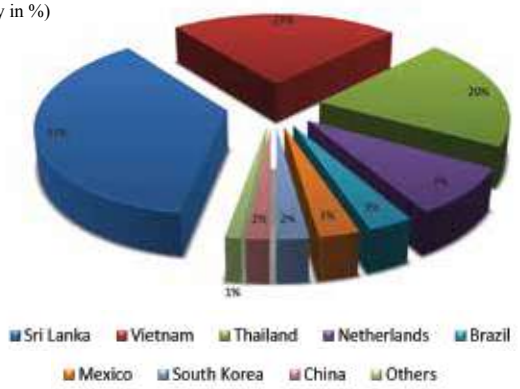


Table 7

Export of Coconut shell charcoal during April to September 2016		
Country	Quantity (in MT)	Value (Rs in lakhs)
Sri Lanka	4503.78	1167.05
Vietnam	2826.00	639.57
Thailand	2520.00	549.73
Netherlands	1047.90	347.30
Brazil	399.00	87.87
Mexico	360.00	117.97
South Korea	282.00	84.56
China	199.00	47.57
Others	133.64	59.85
Total	12271.32	3101.49

During the first six months of the financial year 2016-17, India imported Rs. 218.01 crores worth coconut products. Copra expeller cake and coconut fatty acid were the major items imported during this period. Details of import of coconut products into India during the period from April to September 2016 is given in table 8.

Import of coconut products to India during the period April to September 2016								
Item	September 2015		September 2016		April to September 2015		April to September 2016	
	Quantity (in MT)	Value (Rs. In lakhs)	Quantity (in MT)	Value (Rs. In lakhs)	Cum. Quantity (in MT)	Cum. Value (Rs. In lakhs)	Cum. Quantity (in MT)	Cum. Value (Rs. In lakhs)
Copra oil cake	13282.12	2169.12	20396.35	3563.18	54705.65	8681.97	89417.36	14502.91
Coconut fatty acid	703.05	456.30	712.97	778.70	4092.55	3313.43	5308.01	5033.90
Cream-milk-powder	30.53	79.08	80.57	91.70	30.53	636.45	167.09	1396.02
Coconut shell charcoal	1458.64	473.98	0.12	0.04	9049.66	2833.32	326.39	96.87
coconut oil	1995.51	1575.50	4.76	17.57	3313.69	2795.24	4.83	17.94
Copra	47.00	33.42	0.00	0.00	170.27	126.21	0.00	0.00
Misc coconut products		88.02		146.29		749.86		753.24
Total		4875.42		4597.48		19136.47		21800.88

Table 8

Coconut Fatty Acid

Import of coconut fatty acid into India during the first six months of the financial year 2016-17 was 5308.01 MT, out of which 5094.07 MT was from Malaysia. Import of coconut fatty acid during the corresponding period of last year was 4092.55 MT. Details of import of coconut fatty acid to india from April to September 2016 is given in table 9.

Import of coconut fatty acid during April to September 2016		
Country	Qty (in MT)	Value (Rs. In lakhs)
Malaysia	5094.07	4835.48
Indonesia	123.20	109.73
Other	90.74	88.70
Total	5308.01	5033.90

Table 9

(quantity in %)

Copra expeller cake

In terms of quantity and value, copra expeller cake is the major coconut product imported to India. During the first six months of the financial year 2016-17, the quantity of import of this product was 89417.36 MT of which 49600.00 MT was from Indonesia. Details of import during the period April to September 2016 is given in table 10.

(quantity in %)

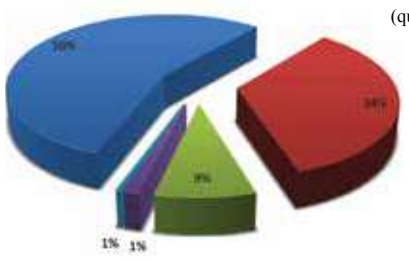


Table 10

Import of coconutoil cake during April to September 2016		
Country	Qty (in MT)	Value (Rs. In lakhs)
Indonesia	49600.00	7589.71
Philippines	30600.00	5207.80
Sri Lanka	7588.68	1420.58
Papua New Guinea	1271.33	227.71
Others	357.35	57.10
Total	89417.36	14502.91

Market review – September 2016

Domestic price

Coconut Oil

The price of coconut oil in Kochi, Alappuzha and Kozhikode market expressed a slight erratic trend during September. The prices showed a downward trend during the first week of September and from the second week onwards the prices expressed an upward trend. In the last week the prices expressed a slight downward trend. The monthly average price of coconut oil at Kochi market was Rs.9693 per quintal and at Alappuzha market was Rs.9672 during the month of September. At Kozhikode market the monthly average price of coconut oil was Rs.10187 per quintal. But at Kangeyam market in Tamil Nadu, fluctuations in price was more pronounced with a monthly average of Rs.8850 per quintal. In all the major markets, prices closed with a slight downward trend except Kozhikide market.

Table1: Weekly average of price of coconut oil at major markets Rs/Quintal)

	Kochi	Alappuzha	Kozhikode	Kangayam
04.09.2016	9500	9600	9900	8478
11.09.2016	9400	9417	9850	8500
18.09.2016	9650	9500	10175	8939
25.09.2016	9880	9867	10367	9189
30.09.2016	9870	9910	10500	8980
Average	9693	9672	10187	8850

The prices at Kochi, Alappuzha and Kozhikode markets were 4-8 percent more than that of the previous month and 15-18 percent lower than the prices prevailed in September 2015.

Milling copra

The prices of milling copra at major markets moved in tune with the prices of coconut oil. The prices expressed a downward trend during the first week but increased slightly from the second week onwards. The prices closed with a slight downward trend in all three markets. At Kochi market, the monthly average price of FAQ copra was Rs.6345 per quintal. The monthly average prices of copra at Alappuzha market was Rs.6180 per quintal and at Kozhikode market was Rs.6239 per quintal. The prices of Kochi, Alappuzha and Kozhikode markets were 4-5 percent more than that of the previous month and 21-23 percent lower than the prices prevailed in September 2015.

At Kangayam Market in Tamil Nadu, fluctuation in the price was more pronounced. The monthly average price was Rs.6050 per quintal which was 5 percent more than the previous month and 19 percent lower than corresponding month last year.

Table2: Weekly average price of Milling Copra at major markets (Rs/Quintal)

	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
04.09.2016	6200	6075	5950	5767
11.09.2016	6150	5958	5958	5792
18.09.2016	6300	6038	6325	6117
25.09.2016	6480	6358	6417	6317
30.09.2016	6470	6390	6410	6130
Average	6345	6180	6239	6050

Edible copra

The price of Rajapur copra at Kozhikode market also expressed slight fluctuating trend during the month. The monthly average price of Rs.7889 per quintal was 4 percent more compared to the previous month price and 43 percent lower compared to the price prevailed in the corresponding month last year.

Table3 :Weekly average of price of edible copra at Kozhikode market (Rs/Quintal)	
04.09.2016	7525
11.09.2016	7750
18.09.2016	7975
25.09.2016	8117
30.09.2016	7860
Average	7889

Ball copra

The price of ball copra at Tiptur market expressed a fluctuating trend. The monthly average price of ball copra at this market was Rs.6976 per quintal which was 6 percent lower compared to previous month price and 43 percent lower compared to price prevailed in September 2015.

At Arsikere APMC market in Karnataka, the monthly average price of ball copra was Rs.6923 per quintal. This was 2 percent lower compared to the previous month's average price and 36 percent lower compared to price prevailed in September 2015.

Table 4 : Weekly average of price of Ball copra at major markets in Karnataka (Rs/Quintal)		
	Tiptur	Arsikere
04.09.2016	7037	7034
11.09.2016	7235	7061
18.09.2016	6940	6812
25.09.2016	6933	6870
30.09.2016	6820	6783
Average	6976	6923

Dry coconut

At Kozhikode market the price of dry coconut expressed a slight declining trend during the month. The monthly average price of Rs.5300 per quintal was 4 percent lower compared to previous month price and 50 percent lower compared to the previous year price.

Table5 : Weekly average of price of Dry Coconut at Kozhikode market (Rs/1000 coconuts)	
04.09.2016	5500
11.09.2016	5333
18.09.2016	5300
25.09.2016	5300
30.09.2016	5180
Average	5300

Coconut

The price of coconut at Nedumangad market remained same at Rs.9000 per thousand nuts throughout the month which was 20 percent higher when compared to previous month and 21 percent lower compared to the price prevalent in September 2015.

The market price of partially dehusked coconut at Arisikere market expressed a slight fluctuating trend during the month. The monthly average price at this market was Rs.8525 per thousand nuts.

At Bangalore APMC the monthly average price of partially dehusked coconut was Rs.7641 per thousand nuts which was 13 percent lower than that of the previous month and about 49 percent lower than that of corresponding month last year.

At Manglore APMC market the monthly average price of partially dehusked coconut was at this market at Rs.13158 per thousand nuts. It was marginally higher than that of the previous month and about 17 percent lower than that of the corresponding month last year.

Table 6: Weekly average of price of coconut at major markets (Rs /1000 coconuts)

	Nedumangad	Arsikere	Banglore	Mangalore (Grade-1)
04.09.2016	9000	8000	7250	13000
11.09.2016	9000	7700	7250	13000
18.09.2016	9000	8180	7250	13000
25.09.2016	9000	9356	8500	13250
30.09.2016	9000	8725	NR	13500
Average	9000	8525	7641	13158

Tender coconut

The price of tender coconut at Maddur market expressed an erratic trend during the month. The monthly average price of tender coconut at Maddur APMC market in Karnataka was Rs.9828 per thousand nuts, which was 2 percent lower than that of the price prevailed in the corresponding month last year.

Table7 : Weekly average of price of tender coconut at Maddur market (Rs/1000 coconuts)

04.09.2016	10000
11.09.2016	9400
18.09.2016	10000
25.09.2016	9783
30.09.2016	10000
Average	9828

International price

Coconut oil

The price of coconut oil at Europe and Indonesia expressed a slight fluctuating trend during the month whereas the price of coconut oil at Philippines market expressed a declining trend. The domestic price of coconut oil in India appears to be competitive. The domestic price of coconut oil opened at US$ 1422 and closed at 1483 per MT. The price of coconut oil quoted at different international markets is given below.

Table 8: Weekly average Price coconut oil in major coconut oil producing countries September 2016

	International Price(US$/MT)	Domestic Price(US$/MT)		
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia Indonesia	India*
02.09.2016	1565	1529	1515	1422
09.09.2016	1570	1520	1532	1412
16.09.2016	1550	1510	1513	1442
23.09.2016	1580	1506	1553	1479
30.09.2016	1480	1503	1446	1483
Average	1549	1514	1512	1439

* Kochi Market

Copra

Price of copra in Philippines and Indonesia expressed a slight downward trend during the month. The price of copra in India expressed an upward trend by the end of the month. Price of copra in Srilanka was the highest among all the major copra producing countries.

Table 9: Weekly average Price of copra in major copra producing countries September 2016

	Domestic Price(US$/MT)			
	Philippines	Indonesia	Srilanka	India*
02.09.2016	926	NR	1300	928
09.09.2016	895	869	1300	924
16.09.2016	873	928	1300	941
23.09.2016	874	918	1300	970
30.09.2016	873	891	1300	972
Average	888	902	1300	941

* Kochi Market

Desiccated coconut

The FOB price of desiccated coconut in India during the month of September was very competitive compared to the prices of major DC exporting countries. Price of desiccated coconut in Philippines market appears to be much higher than the other major desiccated coconut manufacturing countries.

Table 10: Weekly average price of desiccated coconut in September 2016

	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
02.09.2016	2458	2050	2178	1451
09.09.2016	2458	2050	2112	1494
16.09.2016	2431	2080	2112	1579
23.09.2016	2431	2080	2160	1510
30.09.2016	2431	2080	2144	1567
Average	2442	2065	2141	1509

*FOB

Coconut

The price of dehusked coconut in Srilanka and Indonesia showed a increasing trend during the month. In Philippines market the price declined during the first 2 weeks and then increased and closed with an upward trend. In India the price of coconut expressed a fluctuating trend. The domestic price of dehusked coconut in India was slightly higher compared to other major coconut producing countries.

Table 11: Weekly average price of dehusked coconut with water during September 2016

Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
02.09.2016	191	208	193	251
09.09.2016	188	208	196	248
16.09.2016	183	212	196	258
23.09.2016	190	212	198	266
30.09.2016	194	216	200	258
Average	187	211	197	256

*Pollachi market

Coconut shell charcoal

The FOB price of coconut shell charcoal in India expressed a slight fluctuating trend during the month. Philippines quoted the lowest price. Whereas Srilanka's price was the highest among major coconut shell charcoal exporting countries.

Table 12: Weekly average price of coconut shell charcoal during September 2016

Date	Domestic Price(US$/MT)			
	Philippines	Indonesia	Srilanka	India
02.09.2016	340	380	450	347
09.09.2016	340	380	450	360
16.09.2016	340	380	450	350
23.09.2016	340	380	440	377
30.09.2016	340	380	440	360
Average	340	380	446	359

*FOB

Monthly operations in November

Andaman & Nicobar Islands: Treat stem bleeding affected palms if any. After removing the affected tissues on the stem, apply 5 per cent calixin on the wound. When it dries apply warm coal tar. Application of 5 per cent calixin (5 ml in 100 ml water) at quarterly intervals by root feeding thrice a year during June, October and January will prevent further spread of lesions. Apply 5 kg neem cake per palm per year along with the second dose of fertilizers to the affected palms. Regulate field moisture by providing drainage during rains and irrigating the palms during summer. Remove ungerminated and dead sprouts from the nursery.

Andhra Pradesh: In low lying areas, plant one year old seedlings in the main field. If there is attack of black headed caterpillar, spray young seedlings with 0.2 per cent dichlorvos/0.05 per cent endosulphan/0.05 per cent phosalone on the lower side of the leaves. On older palms, release specific parasites according to the stage of the pest. Inject the red palm weevil affected palms with one per cent carbaryl. When the pest entry is through the trunk put Aluminum phosphide tablets @1-2 tablets per tree in the holes and plug with cement or plaster and allow to set. Isolate Ganoderma wilt affected palms from healthy ones by digging trenches of 30 cm width and one metre depth, 2 metres away from the diseased palms. Treat the palms with 5 per cent calixin (5 ml in 100 ml water) at quarterly intervals by root feeding for one year. Grow leguminous crops in the garden. Apply neemcake @ 5kg/ palm/ year. Apply the second dose of fertilizers i.e. 750 g urea, 1300 g single superphosphate and 1300 g muriate of potash per adult palm, if not applied in October.

Assam: If Ganoderma disease is noticed remove the badly affected palms and dig isolation trenches of 30 cm width and 1m depth, two metres away from the diseased palm. Treat the palms with 5 per cent calixin (5 ml in 100 ml water) at quarterly intervals by root feeding and apply 5 kg neem cake per palm. Treat the crown choke affected palms by the application of 50g borax per palm at half yearly interval.

Bihar / Madhya Pradesh/Chhattisgarh: Keep the garden free of weeds. Remove the soil from the collar region of the newly planted seedlings. Apply the first dose of fertilizers. In order to protect the seedlings from winter effect, provide shade. Search for the attack of termites. If found, clean the

termite galleries from the affected portion and apply 0.05 per cent chlorpyriphos twice at 20-25 days interval. Irrigate the garden. Cultivate vegetables as intercrops.

Karnataka: Plough the garden and keep nursery free of weeds. Start irrigation if dry spell prevails. Apply the 2nd dose of fertilizers if not applied during October. Crown cleaning may be taken up if not done in earlier months. Bordeaux mixture may be sprayed if not applied last month.

Kerala/Lakshadweep: Manure the young seedlings. Start the post monsoon prophylactic spraying of the palms. Discard the seedlings in the nursery which exhibit poor growth and delayed germination. Provide shade to the nursery. Select mother palms for collection of seednuts. In gardens where vegetables are grown under irrigation, transplant the vegetable seedlings. To control the leaf rot disease in root (wilt) affected areas, pour Hexaconasol (Contaf 500) @ 2 ml per 300 ml water per palm, after cutting and removing the rotten portion of the spindle and the innermost fully opened leaves. Apply 20 gm phorate 10G mixed with 200 gm sand around the base of the spindle. If mite infestation is noticed clean the crowns of the palms and spray neem oil - garlic - soap emulsion 2 percent (20 ml neem oil + 20 gm garlic emulsion +5 gm soap in 1 litre water) or azadiractin 1 % (Neemazal) @ 4ml per litre of water or root feed 5 % azadiractin @ 7.5 ml with equal quantity of water.

Maharashtra/Goa/Gujarat: Weed the garden. Clean the irrigation channels. Spray the palms with

one per cent bordeaux mixture.

Orissa : Continue the ploughing in low-lying areas to conserve moisture. Remove weeds and grass and burn them. Transplant seedlings of winter vegetables.

Tamil Nadu/Puducherry : Irrigate the young seedlings. Keep the nursery free of weeds and continue discarding poor seedlings. Select mother palms for subsequent seednut collection. Palms affected with mite infestation may be applied with neem oil-garlic- soap emulsion 2 per cent, i.e. 20 ml neem oil+5 gm soap in 1 litre of water or azadiractin 1 per cent @ 4 ml per litre of water on the perianth region of buttons and affected nuts. Root feeding 5% azadiractin @ 7.5 ml with equal quantity of water is also effective. Apply 20 gm phorate 10G mixed with 200 gm sand around the base of the spindle against rhinoceros beetle and red palm weevil.

Tripura: Entire garden should be cleaned properly if not done earlier. Newly planted seedlings should be provided shade to protect them from sun scorching. Mulching should be done with dry leaves and husk around the palms for moisture retention. To avoid attack of white ants, drench the nursery with 0.05 per cent chlorpyriphos twice at 20-25 days interval depending upon the severity of infestation. The affected trunk may be swabbed with the above chemical.

West Bengal: Apply the second dose of fertilisers if not applied during October. Discard seedlings which exhibit poor growth and delayed germination in the nursery. ■