



# Thirty years of triumph & tribulations in Integrated Development of Coconut Industry in India

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**The development of coconut culture and industry in India received impetus with the setting up of CDB in 1981.**

**The Board has been implementing the scheme "Integrated Development of Coconut Industry in India" since its inception.**

## Introduction

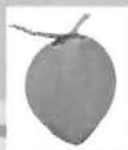
The cultivation of coconut is distributed in 93 countries in seven continents in the world covering an area of 12.16 million ha with an annual production of 61.08 billion nuts. Indonesia, Philippines, India, and Sri Lanka are the major suppliers of coconut in the world. These countries together, account for 79 per cent of world production. India accounts for 16.44 per cent in area and 27.04 per cent in the production of coconut in the world. In India, this crop is cultivated in 18 states and 3 Union Territories. It is considered as a national fruit consumed by every Indian for diversified uses. It is estimated that there are 5 million coconut holdings in the country, of which 98 percent are below 2 ha in size. In Kerala coconut is the main stay of the people with the entire fabric of rural economy closely woven around it. Coconut contributes significantly to the GDPs of the states of Tamil Nadu, Karnataka, Andhra Pradesh, Goa and UTs of Lakshadweep, A&N Islands and Pondicherry. Thus coconut is eulogized as "Kalpavriksha", which provides food and livelihood-security

to more than 10 million people in the country besides guaranteeing employment opportunities to rural poor.

## Indian Coconut Sector: An over view

Even though coconut is grown in India since time immemorial, concerted efforts for the integrated development of the crop began only with the establishment of the Indian Central Coconut Committee in 1945, which had the strategy of intensifying coconut development and research in the country. Since then R & D efforts were being initiated and implemented in the country to boost the production as well as to spread the scientific cultivation to new areas. Historically, the cultivation of coconut has been confined to the east and western coastal states. Apart from meeting the domestic requirements of these states, the demand for coconut and coconut products for the non-producing states were also met from the traditional coconut producing southern states. The increasing demand for coconut on account of demographic growth as well as the market expansions necessitated the

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establishment of an exclusive agency for crop development. Thus the Directorate of Coconut Development under the Union Ministry of Agriculture was set up in 1966 after dissolving the Committee at Kochi, Kerala, to look after the crop development in the country. The development of coconut became an important agenda in both Central and State Government's Plans. The area and production of coconut in the country particularly in the traditional coconut growing states has been increasing considerably. The growth in area and production of coconut further resulted in the establishment of many down stream industries. As a result of these developments, coconut has become an important cash crop apart from being a source of food and oil seed crop to a major segment of population particularly in the south. Hence the growth of the coconut sector in India has been an impetus to the growth of the coconut based industries which in turn created large-scale rural employment and tax revenue for government. The more demand for coconut and its products created new horizon for its expansion, particularly to newer areas of the country.

The establishment of the Coconut Development Board, in 1981 was an added fillip to coconut culture and industry in the country. It has also opened new vistas for technology development, product diversification, by-product utilization and value addition besides the expansion of the crop in non-traditional areas of central and North-Eastern Regions. The area under and the production of coconut in the country is increasing rapidly since the last three

decades. The coconut cultivation in the country during 1960s was pegged at 7.17 lakh ha with a production of 4639 million nuts with a per capita availability of 10 nuts respectively which was declined to 9 nuts in 1981 despite the fact that there was an increase of gross production of coconut. At the time of setting up of the Coconut Development Board in 1981-82, the area and production of coconut in the country reached to 10.91 lakh ha and 5940 million nuts. The percentage change in area was 51 and that of production was 33. The compound growth rate in area and production of coconut during these periods was 1.89 per cent and 1.3 per cent per annum respectively. The productivity of coconut declined considerably to 5445 nuts per ha in 1981-82 from the level of 6466 nuts per ha in 1960-61.

The establishment of the Board was a fillip to the coconut culture and industry. There was a quantum jump in area and production of coconut in the country. The area reached to the level of 18.95 lakh ha in 2008-09 and that of production to 15729.7 million nuts recording an annual compound growth rate of 1.95 in area and 3.41 in production. The per capita availability of coconut has considerably increased to 14 nuts in the country. While the productivity during the pre-CDB period was recording a negative growth, it has considerably increased to 8303 nuts per ha which is 51 per cent more than that of the productivity of 1960-61. As a result of the concerted efforts by the Board, the production and productivity of coconut in the country has improved significantly. Apart from enhancing the supply of

coconut in the country, the Board played a salutary role in the field of post harvest processing of coconut. The copra-coconut oil centered industry has been diversified and tremendous progress achieved in the field of product diversification and by-product utilization of coconut. Many technologies were developed in association with premier Research Institutions in the country. The technologies developed for the manufacture of various products like; coconut cream, spray dried coconut milk powder, packed and preserved tender coconut water, virgin coconut oil and by-products like; coconut water based vinegar, na-ta-de-coco, industrial utilization of wood for the manufacture of particle boards etc. are the milestone achievements of the Board. Thus the Coconut Development Board plays a pivotal role in enhancing the production and productivity of coconut in the country besides bringing a structural change in the field of post harvest management. The four Southern States viz., Kerala, Tamil Nadu, Karnataka and Andhra Pradesh are continuing to hold the hegemony of coconut acreage and production in India.

### **Coconut development in India: A Preview**

The progress of the Indian Coconut Sector during the past three decades, ie, the post CDB period, can be classified under three distinct areas. Firstly considerable progress has been achieved in extending the cultivation of the crop in more areas both traditional and non-traditional. Secondly, the increase in area, production and productivity of coconut in the country with the



regress in the consumption of coconut oil in both edible and non-edible sector has lead to the development of broad based processing technologies for product diversification and by-product utilization for the sustainable growth of the industry. Thirdly the problem of low income from the coconut holdings due to price fluctuations, low value realization and decline in the prices of coconut and its products. The noncompetitive nature of the industry has necessitated the need for the adoption of an integrated approach in the development of coconut cultivation and industry in the country.

Though coconut and its products have found extensive uses throughout the country by all Indians, its substantial production is emerged from the four southern states, viz. Kerala, Tamil Nadu, Karnataka and Andhra Pradesh accounting for more than 90% of the coconut production in the country. The other states like Goa, Orissa, West Bengal, and Assam also account for a sizeable area and production of coconut. The state-wise details of area and production of coconut in the country is given in Table - 1.

Kerala, a small state with 1.18 per cent of the total land area of the country, once accounted for 58 per cent in area under coconut and 50 per cent in production in the country. The scarcity of cultivable land, growth in real estate business activities and high speed of urbanization and pace in the substitution of coconut area for more remunerative crops like rubber, have resulted decelerating growth in area

Table 1. Trend in area, production & productivity of coconut in India for the Year 2008-2009

States/UT	Area ('000 Hectares)	% Share	2008 - 2009		
			Production (Million Tons)	% Share	Yield (Nuts/Ha)
Andhra Pradesh	104.00	5.49	970.00	6.17	9327
Assam	18.80	0.99	147.1	0.94	7824
Goa	25.61	1.35	128.18	0.81	5005
Gujarat	15.98	0.84	157.42	1.00	9851
Karnataka	419.00	22.12	2176	13.83	5193
Kerala	787.77	41.58	5802	36.89	7365
Maharashtra	21.00	1.11	175.1	1.11	8338
Nagaland	0.92	0.05	0.55	0.00	598
Orissa	51.00	2.69	275.8	1.75	5408
Tamil Nadu	389.60	20.56	5365	34.11	13771
Tripura	5.80	0.31	11.4	0.07	1966
West Bengal	28.60	1.51	355.5	2.26	12430
A & N Islands	21.69	1.14	82	0.52	3781
Lakshadweep	2.70	0.14	53	0.34	19630
Pondicherry	2.10	0.11	30.7	0.20	14619
All India	1894.57	100.00	15729.75	100.00	8303

under coconut. However, the growing dimension of population warranted the need for enhancing the production of the state as well as the other states. After the establishment of the Board, the Board has initiated various measures for the integrated development of coconut cultivation and industry in the country. Even though, 28 per cent of the total cropped area in the state is under coconut and the crop is an important source of livelihood to both growers and traders, the state is losing its share to other competitive states. The share in area and production of coconut reached to 42 and 37 per cent respectively. The bulk of the coconut acreage in the state is now concentrated in low-land and mid-land regions. The unique feature of this crop in the state is its homestead nature of cultivation and varying type of harvesting. It is estimated that there are 5 million coconut holdings in the country and out of which about 3.5 million holdings are distributed in Kerala. The average size of the coconut holdings in the state is only 0.2 ha. The contribution

of the crop to the annual income of the state is around 15 per cent and to the agricultural income is 35 per cent. The coconut based processing industries and other activities provide direct employment opportunities to over a million people in the state and sustain inter state trading in coconut products amounting to a gross annual turn over of about Rs.20,000 crores.

Even though Kerala accounts for major share in area and production of coconut, its hegemony in supply and trade is diminishing due to the diminishing nature of production and productivity. Though various reasons are attributed to this unimpressive situation, the wide spread incidence of root (wilt) and prevalence of old and unproductive palms in the existing populations are the major factors for the low productivity of gardens. The declining productivity and diminishing rate of return per unit holdings have been the major causes of concern in the state. The poor and unscientific management of the gardens are the major hurdles for the



low productivity of coconut in Kerala. The salubrious and catalytic role played by the Board during the past three decades in the state has changed the coconut situation considerably. While the area has been increasing only at low rate of 0.62 per cent the production and the productivity of coconut has increased at a compound growth rate of 2.47 and 1.83 per cent annually. In case of production and productivity the increase was more or less continuous. (See Fig-1, 2 and 3).

Tamil Nadu ranks second in the production of coconut in the country. Coconut occupies 4.7 per cent of the total cropped area of the state and is considered the largest among all the horticultural crops grown in the state. It is grown in all the 28 districts of the

state having the maximum coverage of 85,800 ha with a production of 742.4 million nuts in Coimbatore district. The other major coconut growing districts are Dindigul, Dharmapuri, Thiruchirappalli, Madurai, Kanniyakumari, Thanjavur, Vellore, Salem, Erode, Nagapattinam, and Thirunelveli. About 84.06 per cent of area under and 89.18 per cent of production of nuts in the state is emanated from these districts. The cultivation of coconut in the state gained momentum subsequent to the functioning of the Board's States Center at Thanjavur in 1987. The State Center has since been elevated to a Regional Office and is located at Chennai. There has been a quantum jump in the acreage under coconut. Though Tamil Nadu is a traditional coconut growing state, the

states share in area and production of coconut in the country was only 12 and 22 per cent during 1985-87. The efforts of the Board in bringing more area under scientific cultivation and management have been making tangible results in the states as a long term measure for increasing the supply of coconut in the country. The normal annual rain fall in the state is 977.5 mm which is inadequate for successful coconut growing. However, the measures initiated by both CDB and the State Government were helpful in bringing more area under irrigation management. Currently, most of the coconut gardens in the state are being maintained under irrigation. The production of coconut which was pegged at 1945 million nuts in 1985 has now reached to 5365 million

Table 2. Trend in area, production and yield of coconut in India

YEAR	Coconut Area, Production and Productivity since 1981																	
	KERALA			KARNATAKA			TAMIL NADU			ANDHRA PRADESH			OTHERS			ALL INDIA		
	Area "000 ha	Production Million Nuts	Productivity Nuts/ha	Area "000 ha	Production Million Nuts	Productivity Nuts/ha	Area "000 ha	Production Million Nuts	Productivity Nuts/ha	Area "000 ha	Production Million Nuts	Productivity Nuts/ha	Area "000 ha	Production Million Nuts	Productivity Nuts/ha	Area "000 ha	Production Million Nuts	Productivity Nuts/ha
1981-82	666.6	3005.7	4509	176.4	917.6	5202	116.2	1385.7	11925	43.3	178.9	4132	88.3	452.0	5119	1090.80	5939.9	5445
1982-83	674.4	3184.0	4721	182.6	950.3	5204	143.9	1434.6	9969	44.7	184.9	4136	103.6	602.3	5814	1149.20	6356.1	5531
1983-84	682.3	2602.0	3814	190.3	990.9	5207	137.1	1368.1	9979	46.5	192.4	4138	109.4	654.5	5983	1165.60	5807.9	4983
1984-85	687.5	3453.0	5023	200.5	1037.2	5173	139.9	1537.3	10989	47.1	194.5	4130	108.3	690.8	6379	1183.30	6912.8	5842
1985-86	704.7	3377.0	4792	205.6	1062.0	5165	149.6	1494.5	9990	47.4	195.8	4131	118.3	641.0	5418	1225.60	6770.3	5524
1986-87	706.1	3173.0	4494	207.4	1066.3	5141	156.3	1234.2	7896	48.1	198.8	4133	113.3	704.5	6218	1231.20	6376.8	5179
1987-88	775.4	3346.0	4315	213.1	1096.5	5145	189.5	1578.3	8329	48.8	480.3	9842	119.2	768.8	6450	1346.00	7269.9	5401
1988-89	816.9	4215.0	5160	220.3	1134.6	5150	214.2	1917.8	8953	52.0	511.2	9831	122.1	762.8	6247	1425.50	8541.4	5992
1989-90	832.2	4357.6	5236	226.3	1166.5	5155	225.9	2302.4	10192	59.0	654.8	11098	128.8	877.5	6813	1472.20	9358.8	6357
1990-91	864.1	4527.3	5239	232.9	1201.6	5159	226.4	2358.3	10417	61.2	730.6	11938	129.3	882.4	6824	1513.90	9700.2	6407
1991-92	846.3	4206.1	4970	238.6	1227.6	5145	240.3	2755.8	11468	63.4	959.2	15129	140.3	930.9	6635	1528.90	10079.6	6593
1992-93	877.0	5125.2	5844	246.0	1269.7	5161	196.4	2771.1	14109	71.7	1081.8	15088	146.6	993.1	6774	1537.70	11240.9	7310
1993-94	882.3	5197.0	5890	252.9	1308.0	5172	272.8	3311.4	12139	79.9	1103.5	13811	147.2	1054.8	7166	1635.10	11974.7	7324
1994-95	911.0	5335.1	5856	263.8	1364.1	5171	298.6	4345.7	14554	86.6	1181.4	13642	153.8	1073.3	6979	1713.80	13299.6	7760
1995-96	980.0	5908.0	6029	278.8	1450.9	5204	322.5	3257.6	10101	90.0	1231.4	13682	159.6	1104.4	6920	1830.90	12952.3	7074
1996-97	1010.0	5759.0	5702	290.0	1493.0	5148	328.0	3811.6	11621	90.0	685.9	7621	174.5	1238.0	7095	1892.50	12987.5	6863
1997-98	1020.3	5911.0	5793	302.4	1550.4	5127	266.5	3096.7	11620	94.9	815.0	8588	176.9	1344.2	7599	1861.00	12717.3	6834
1998-99	882.3	5132.0	5817	310.4	1611.5	5192	285.0	3335.3	11703	98.0	698.1	7123	178.8	1759.0	9838	1754.50	12535.9	7145
1999-00	899.1	5167.0	5747	321.2	1671.8	5205	304.0	3222.0	10599	101.7	1051.8	10342	142.1	1016.4	7153	1768.10	12129.0	6860
2000-01	925.8	5536.0	5980	333.8	1754.2	5255	323.5	3192.0	9867	102.6	1092.7	10650	138.2	1103.5	7985	1823.90	12678.4	6951
2001-02	939.5	5744.0	6114	369.8	1503.6	4066	335.8	3293.6	9808	104.0	1125.0	10817	183.2	1296.7	7078	1932.30	12962.9	6709
2002-03	899.2	5709.0	6349	375.4	1525.3	4063	345.9	2860.7	8270	105.2	1158.6	11013	196.1	1281.4	6534	1921.80	12535.0	6523
2003-04	906.2	5484.0	6052	376.0	1529.1	4067	352.7	2560.5	7260	104.0	1195.0	11490	194.8	1409.6	7236	1933.70	12178.2	6298
2004-05	897.8	5727.0	6379	385.4	1209.6	3139	357.1	3243.5	9083	104.0	1199.3	11532	190.7	1453.5	7622	1935.00	12832.9	6632
2005-06	897.8	6326.0	7046	385.4	1209.8	3139	370.6	4867.1	13133	104.0	892.0	8577	189.0	1516.2	8022	1946.80	14811.1	7608
2006-07	870.9	6054.0	6951	401.0	1625.0	4052	374.6	5429.9	14495	101.9	1326.4	13017	188.4	1405.1	7458	1936.80	15840.4	8179
2007-08	818.8	5641.0	6889	405.0	1635.0	4037	383.4	4968.2	12959	101.3	1119.3	11047	194.7	1380.1	7088	1903.19	14743.6	7747
2008-09	787.8	5802.0	7365	419.0	2176.0	5193	389.6	5365.0	13771	104.0	970.0	9327	194.2	1416.8	7295	1894.57	15729.8	8303
Growth over period	121.2	2796.3	2856.1	242.6	1258.4	-8.5	273.4	3979.3	1845.4	60.7	791.1	5195.3	105.9	964.8	2176.4	803.8	9789.9	2857.1
CGR	0.62	2.47	1.83	3.26	3.25	-0.01	4.58	5.14	0.53	3.30	6.46	3.06	2.96	4.32	1.32	2.07	3.67	1.57

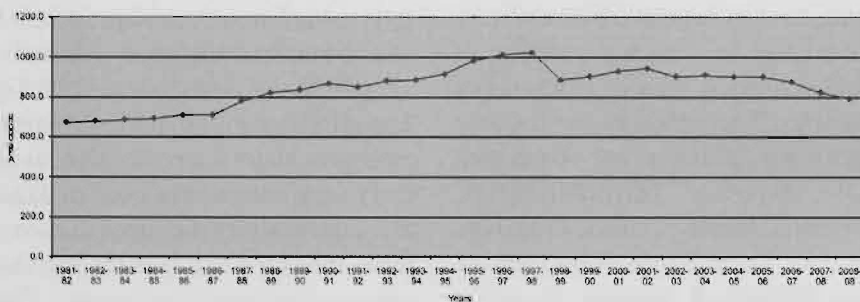


Fig. 1. Trend in area under coconut in Kerala

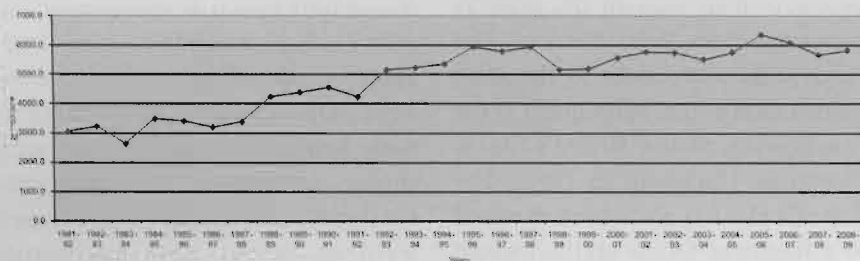


Fig. 2. Trend in production of coconut in Kerala

nuts, recording a significant increase of 259 per cent. Similarly, the area under coconut in the state has also reached to 3.9 lakh ha from the level of 1.5 lakh ha in 1985 recording a compound growth rate of 4 per cent per annum. The Tamil Nadu share in the national production has reached to 34 per cent. The trend in area, production and productivity of coconut in Tamil Nadu is given in Fig 4, 5 and 6. It could be seen that the area and production of coconut in the state is increasing since 1981 with annual fluctuation in the production. The compound growth rates recorded for area, production and productivity were 4.58 per cent, 5.14 and 0.53 per cent respectively. When comparing with the increase in area under coconut with that of production, the rate of increase in production was more pronounced. The present trend indicates that Tamil Nadu may overtake the lead in production of coconut of Kerala shortly. Coconut cultivation and

allied industries have now become the main source of livelihood and employment security for the chunk of the population in the state. It has been reported that there are 3.52 lakh coconut holdings in the state of which 95.4 per cent are less than 1.25 ha. There are about 7000 coir based industries and 200 coconut based industries in the state which provide employment opportunities to more than lakh of people in the state. Thus Tamil Nadu has emerged as the hub of coconut market in the country.

Karnataka accounts for 18.14 per cent of area under and 13.93 per cent of production of coconut in the country. Coconut is the second largest horticultural crop of the state

occupying 31 per cent of the total area under horticultural crops and 2.85 per cent of the total cropped area of the state. The crop is grown in all the districts of the state. The crop is mainly grown under rained conditions. The total area under coconut in the state is 4.19 lakhs ha. The annual production of coconut in the state is 2176 million nuts. Despite the area under coconut in the state is the second highest in the country and is increasing at compound growth rate of 3.26 per cent per annum, the state recorded a lowest productivity. The trend in the production of coconut indicates that the production of coconut in the state is increasing at a compound growth rate of 3.25 per cent per annum which is in commensurate with the increase in area. The trend in area, production and productivity of coconut in Karnataka is given in Fig 7, 8 and 9. Among the coconut growing districts Tumkur ranks first in area and production of coconut in the state. The other important districts are South Karnataka, Mangalore, Shimoga, Hasan, Mysore, Mandya, Chickamangalore and Chitradurga. Nearly 65 per cent of the coconut produced in the state is utilized as raw nuts for domestic culinary purposes and social, cultural and religious purposes. About 25 per cent of the nuts are converted into edible ball copra and desiccated coconut powder and the balance 15

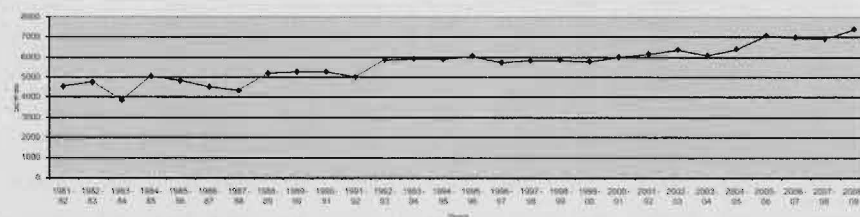


Fig. 3. Trend in productivity of coconut in Kerala

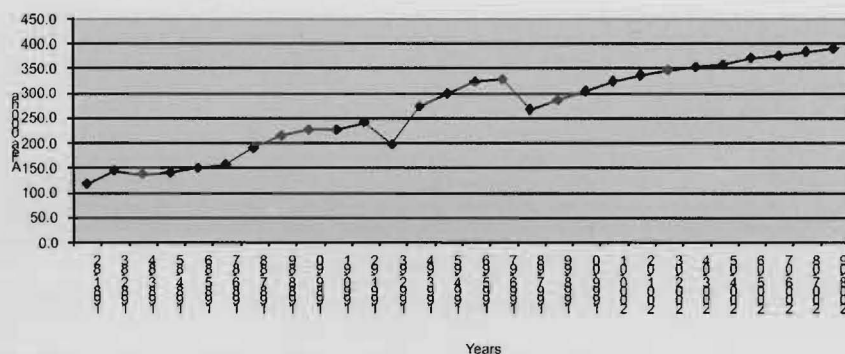


Fig. 4. Trend in area under coconut in Tamil Nadu

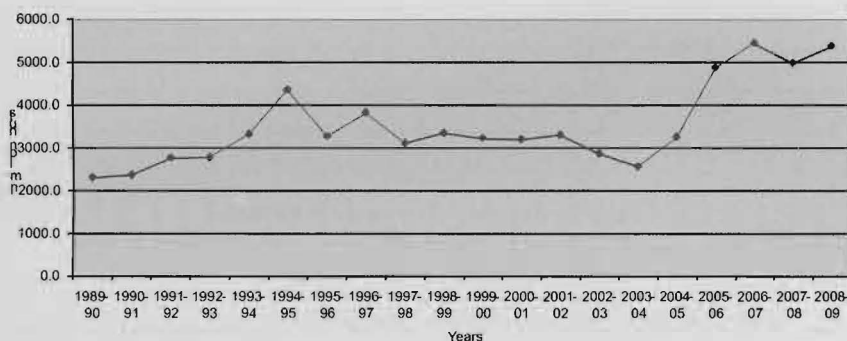


Fig. 5. Trend in production of coconut in Tamil Nadu

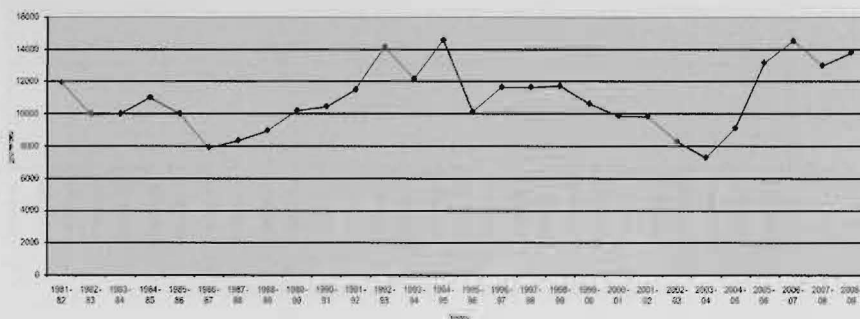


Fig. 6. Trend in productivity of coconut in Tamil Nadu

per cent is utilized as Tender Coconut. About 95 per cent of the edible copra produced in the country is Karnataka's share. Similarly Karnataka hold the hegemony of desiccated coconut powder production. Maddur in Mandya district is considered as the largest Tender Coconut Market in the country. The first manufacturing unit of Packed and Preserved tender coconut water

unit in the country has been established in Maddur during 1999 with the technology developed by CDB and DFRL Mysore.

Andhra Pradesh is an emerging state in the country in the production of coconut. The Konaseema and Udhan areas of the state account for more than 90 per cent of area and production of coconut in the state.

East and West Godhaway, Srikakulam, Vishakapattinam, Krishna and Chittoor districts are the important coconut growing districts of the state. The state accounts for 5 per cent in area and 10 per cent of production of coconut in the country. The trend in area under coconut and the production and productivity is depicted in Fig 10, 11 and 12. Eventhough the area under coconut in the state is increasing at a compound growth rate of 3.3 per cent per annum the production and productivity are increasing significantly at a higher rate of 6.46 and 3.06 per cent per annum which is considered as the highest in the country. A major portion of the production of coconut in the state is used for upcountry sales in the form of partially dehusked nuts which are mainly traded in the non-producing states of Northern India.

### Introduction of coconut cultivation in Non-Traditional States

The establishment of a Regional Office of the Board initially at Patna, Bihar and subsequently shifted to Guwahati in Assam and the State Centers in Bihar, Assam, West-Bengal and Orissa have made a dent in the production and supply of coconut in the north and north-eastern region of the country. The area under and production of coconut in these states has been considerably enhanced and as a result there has been a significant increase in the supply of coconut in these states. At present this region accounts for a share of 10 per cent in area and 9 per cent in the total production of coconut in the country. The increase in area and production of coconut in this region during the past 30 years were at a compound



growth rate of 2.96 and 4.32 per cent respectively. The trend in area and production of coconut indicates that the states of Assam, West Bengal and Orissa will emerge as the major suppliers of coconut in the north eastern region in future.

### Role of Coconut Development Board in the growth of Indian Coconut Industry

The Coconut Development Board since its establishment in 1981 played a pivotal role for the integrated development of coconut cultivation and industry in the country. Many issues in the area of production, processing and marketing were addressed and redressed. The Board has been instrumental in finding solutions on various constraints in the industry and recommending appropriate policy measures to the Government of India for the growth of the industry in the country. The CDB has been implementing various programmes for the integrated development of the coconut culture and industry in the country since its inception. The post harvest management, product diversification and by-product utilization received an impetus after the Board's functioning. The industry has been benefitted with diversified products which in turn is helping to de-link the coconut oil-copra centered market. Many Technologies were developed for manufacturing varied coconut products. The Board in collaboration with the Regional Research Laboratory, Trivandrum has developed technology for the preservation and packing of coconut cream in tin containers with a shelf life of about six months. A pilot

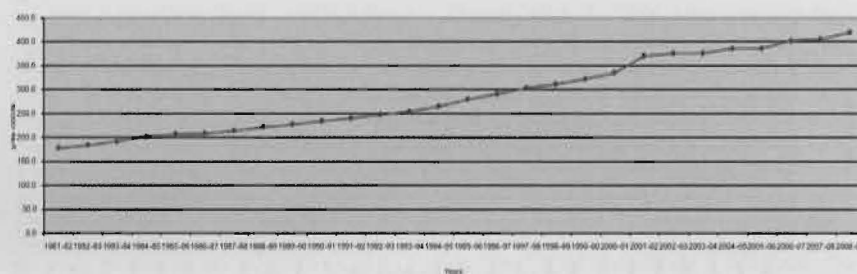


Fig. 7. Trend in area under coconut in Karnataka

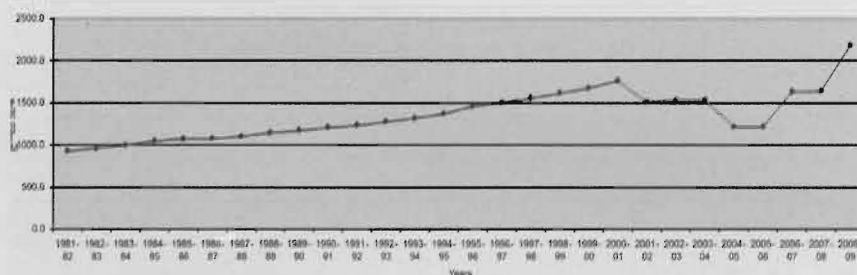


Fig. 8. Trend in production of coconut in Karnataka

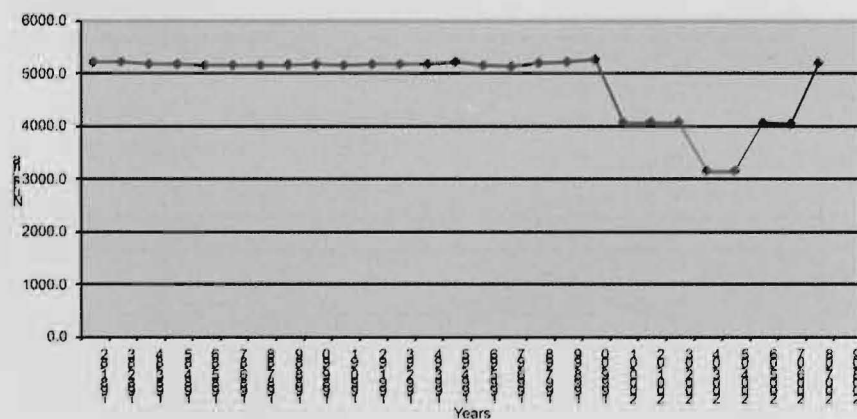


Fig. 9. Trend in productivity of coconut in Karnataka

testing cum demonstration plant was also set up by the Board for the smooth commercialisation of the technology. The technology has since been transferred for commercialization and the product is available in the domestic markets at a reasonable rate.

The development of a technology for Spray Drying of Coconut Milk is another milestone achievement in the field of product diversification

of coconut. The Coconut Development Board in collaboration with the Central Food Technological Research Institute, Mysore has developed technology for spray drying of coconut milk, which is the most potential method for preservation of flavour and texture of coconut milk and has good keeping quality. The product was test marketed by CDB and found acceptable by the consumers throughout the country. The product has

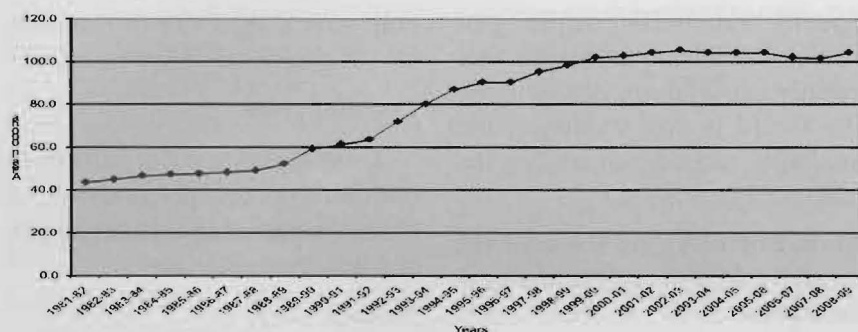


Fig. 10. Trend in area under coconut in Andhra Pradesh

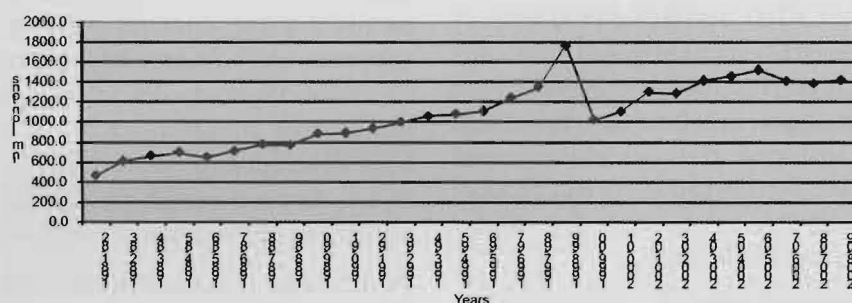


Fig. 11. Trend in production of coconut in Andhra Pradesh

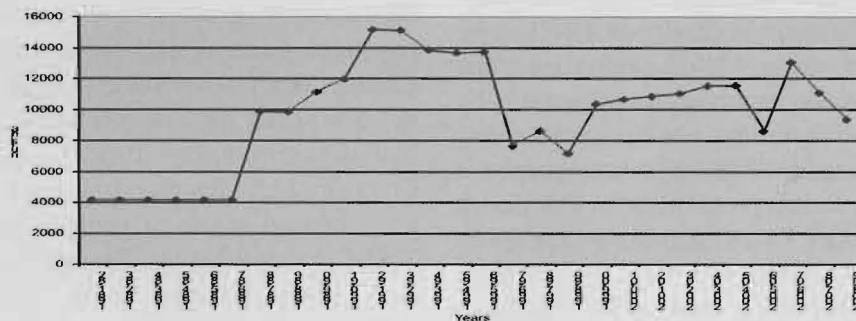


Fig. 12. Trend in productivity of coconut in Andhra Pradesh

consumer demand in both domestic and international markets.

### Preservation and Packing of Tender Coconut Water

The Defence Food Research Laboratory, Mysore under a sponsored project of the Board has developed the technology for preservation and packing of tender coconut water in pouches and aluminium cans. The product has received a fairly good response in the

metropolitan cities as revealed from the consumer acceptability studies conducted by the Board. Seven units with a capacity to process 1.00 lakh tender nut per day has been established with the technical and financial support from the Board, in the states of Karnataka, Tamil Nadu, Gujarat, West Bengal, Andhra Pradesh and Kerala. Procurement of large quantity of tender coconut at a reasonable price is acting as an impediment to this industry.

### Automation of tender coconut water processing system

The Defence Food Research Laboratory, Mysore under a sponsored project of the Board has also developed technologies for mechanical cleaning of tender coconuts, mechanical chopping and collection of tender coconut water, additive treatment and mixing and filling of water into pouches/cans, modification of process (hot filling) for PET bottles, conveyor system to carry pouches/cans to continuous pasteurization system. The technology is being adopted by the existing units for quality upgradation.

### Coconut Vinegar Production from Matured Coconut Water

Mature coconut water is virtually wasted in copra and desiccated coconut production units. The Board in collaboration with the Central Food Technological Research Institute, Mysore has developed a quick generation process for producing quality vinegar from matured coconut water using vinegar generators. This technology has already been transferred to 20 entrepreneurs. A few units have commercialized the product and there is reasonably good demand for the product.

### Snow Ball Tender Nut

Snow ball coconut is the whole round soft kernel pulled out from shell with the water intact in it. Eight month old coconuts are used for the purpose. The CPCRI, Kasaragod under a sponsored project of the Board has developed the technique and fabricated the machinery so as to pull out the whole round soft kernel from the nut. Snow ball tender nut can be packed in LDPE film of



200 gauge, which can be stored for 15 days at about 15°C under refrigerated condition without affecting its keeping quality. This technology is yet to take off commercially.

### **Coconut oil as alternate automobile lubricant**

Cochin University of Science & Technology (CUSAT) and the Board has formulated a viable two stroke engine lubricant using coconut oil suitable for use in tropical countries. This formulation developed through chemical modification by adding additives meets most of the criteria required for two stroke engine oil except pour point. But it can still be used in midland and coastal areas of India where temperature does not fall below 18°C. The project has been undertaken under the Technology Mission on Coconut (TMOC). Further a project for marketing of coconut oil as two stroke automobile engine oil was also sanctioned as a second phase of the project to CUSAT.

A project has also been sanctioned to Indian Institute of Science, Bangalore for Synthesis and characterization of value added products from coconut oil viz industrial lubricants like grease and metal cutting fluids.

### **Dietary fibre from coconut residue**

The importance of dietary fibre in the human diet is gaining more attention due to the increasing awareness of its beneficial effect. The CFTRI, Mysore has carried out a study to develop a natural laxative based on dietary fibre from coconut residue under a sponsored project of the Board. The study proved that water retention capacity, water holding

capacity and swelling capacity of coconut fibre is comparable with other commercially available dietary fibres. The Board is now exploring the possibility of commercializing the findings of the study.

### **Production of Virgin Coconut Oil through cold process of centrifugal separation**

The Coconut Development Board has developed a technology through the CFTRI, Mysore for production of Virgin Coconut Oil by wet processing under Technology Mission on Coconut. Technology has been transferred to 4 entrepreneurs and have established units and product marketed commercially under various brand names.

### **Coconut jelly**

The College of Home Science, Tamil Nadu Agricultural University, Madurai has developed a technology for preparation of coconut Jelly. The process for preparation of coconut jelly using tender coconut water was developed through the sponsored research programme of the Board under TMOC during the year 2008-09. Coconut jelly stored in glass bottles was found to be best up to 180 days.

### **Fruit juice blended tender coconut water**

Process for preparation of fruit juice blended tender coconut water beverage using pomegranate, blue grapes, pineapple, mango and lemon juice have been standardized. Storage studies of these products at room temperature revealed that the beverages were safe for consumption for a period of 6 months.

### **Coconut jam**

Process for preparation of coconut jam using tender coconut

pulp with a shelf life of 6 months also standardized under the study.

### **Coconut chips**

Developed a cost effective technology for preparation of coconut chips using sucrose, jaggery and honey as humectants.

### **Nata-de-coco**

The process for preparation of nata-de-coco (cellulose fibre product) using coconut water as substrate was also standardized by CFTRI in the study. Packagings in transparent stand-up packs have been developed to create visibility of nata-de-coco and the product had a shelf life of 6 months.

### **Pinacolada (coconut milk with pineapple juice)**

The process for preparation of Health drink of coconut milk and pineapple juice in tetra packs and Coconut water based low cost drink in tetra packs were developed by Nadukkara Agro Processing Company Ltd, Muvattupuzha under a sponsored research project of TMOC during 2008-09. The process has been standardized for commercial production of the product pinacolada (coconut milk with pineapple juice) and coconut water based drink in tetra pack. Technology for production of the two coconut based value added products were developed and products were launched in the market under "JIVE" Brand.

### **Faster methods for making ball copra and scale up of natural convection driers with reverse hot air flow**

Two models of driers with capacity to dry 3000 coconuts for the



production of ball copra and 1000 nuts for cup copra were developed by National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram (NIIST) under a sponsored research project of TMOC during 2008-09. The drying period required for each drier and optimum temperature to be maintained in these two driers were standardized. The time required for producing ball copra can be reduced from 12 months to 110 days in the faster dryer developed under the study.

#### **Diversified uses of diseased coconut wood**

A project was sanctioned to the Central Coir Research Institute (CCRI), Kalavoor, Allapuzha under TMOC during the year 2008-09 to explore diversified uses of coconut wood. The objectives are to isolate cellulose from coconut timber and hydrolyze it for producing bio-fuel, extract valuable chemicals like bio-oils form, use the wood as a raw material for particle boards without any resin, convert it into pulp for making hand made paper and to set up a pilot plant for demonstration of technologies. Studies have been completed successfully and the final report would be submitted shortly.

#### **Technology for making value added coconut product from coconut dietary fibre**

Central Food Technological Research Institute (CFTRI), Mysore has developed technology for three coconut based value added products namely, Coconut based instant rice mix, Chutney powder/mix, Filling powder and Coconut bites (Ready-to-eat sweet snack). The products

have been standardized and the shelf life studies have revealed that the product would have a keeping quality of 6 months.

Market survey conducted by IMRB, Mumbai showed that 2 products namely filling mix and Coconut bites had high consumer acceptability followed by Chutney powder/mix & rice mix. The technology has been demonstrated to entrepreneurs in the pilot plant at CFTRI.

#### **Bioconversion of tender coconut waste into high quality organic manure**

Bio conversion of tender coconut shell wastes into organic manure with bio agents, evaluation of various bio agents for bio conversion of tender coconut shell tissues (bits) into organic manure and identification of a promising bio agent and to standardize the process of composting is being perfected at Agricultural Research Station, Ambajipetta, ANGRAU, Andhra Pradesh, under a sponsored programme of the Board under TMOC.

#### **Design and fabrication of an equipments and technique for composting of tender coconut husk**

A project "Design and fabrication of an equipment and technique for composting of tender coconut husk" was sanctioned to Central Coir Research Institute (CCRI), Kalavoor, Allapuzha under TMOC during the year 2007-08. The project has been completed & five machineries namely tender coconut husk slicer, hand operated chopping machine, power operated chopping machine, tender coconut husk

shredder, mini beater etc. has been developed under the project.

#### **Community level production of charcoal and activated carbon from coconut stem wood and shell**

Kerala Forest Research Institute (KFRI), Peechi has developed appropriate technology for community level production of charcoal from coconut stem wood and activated carbon from coconut shell. A pilot plant with an input capacity of 3 tones raw material which can produce about one tone charcoal per day and an FBR with an input capacity of 0.25 tone charcoal which can produce 0.125 tone of active carbon has been designed, fabricated, installed and trial runs conducted.

#### **VCO Through Wet Processing of Coconut**

The CFTRI Mysore under a sponsored project of the Board developed a technology for the manufacturing of Virgin Coconut Oil (VCO) which has got huge demand in both domestic and international market. The wet processing of coconuts is a new process of oil extraction from fresh matured coconuts producing virgin coconut oil rich in vitamin E and possessing long shelf life period of one year. This technology is capable of complete utilization of the coconut. Apart from virgin coconut oil, a number of other value added coconut products like coconut milk, low fat coconut powder, skim milk and packed coconut water, could be developed from the process. A plant processing 1 lakh nuts per day can produce 7.5 tons of virgin coconut oil, 9 tons of medium fat DC, 11,500 liters of matured coconut water 16.5



tons of skim milk and 11.5 tons of coconut shell. The Board has assisted the establishment of many units in the country and the product is available in the domestic market as well as in the world market.

### **Technologies developed for the Industrial Applications**

#### **a) Waste Heat Recovery Technology for Coconut Shell Charcoal Production**

The waste heat recovery technology developed by Natural Resources Institute (NRI), UK is currently available indigenously for coconut shell carbonization. The technology is advantageous in reducing the smoke problem and produces clean and well carbonized charcoal using the coconut shell. The flue gases, during carbonization, is passed through a heat exchanger process, produces heat which could be effectively utilised for drying operation in copra making and D.C. production.

#### **b) Coconut shell powder**

The coconut shell powder finds extensive uses in plywood and laminated board industries, as a phenolic extruder and as a filler in synthetic resin glues, mosquito coils and agarbathy industries. Coconut shell powder is preferred as substitute for bark powder, furfural and peanut shell powder because of uniformity in quality and chemical composition and also has better properties in respect of water absorption and resistance to fungal attack. Coconut shell powder is manufactured from matured coconut shell by using high H.P. pulverizes. A raw material of 12,000 shells yield around one tonne shell powder. The capital investment ranges from Rs 12

lakhs which cover building, plant and machinery and operating expenses, contingency and working capital excluding land cost for about 40 cents. The unit can generate an employment potential of 6-10 personnel per day. The profit margin works out to be around 20 per cent on investment.

#### **c) Activated Carbon**

Activated Carbon is a non graphite form of carbon which could be produced from any carbonaceous material. Coconut shell based activated carbon is considered superior to those obtained from other sources due to its small macro pore structure which renders it more effective for the adsorption of gas/vapor and for the removal of color and odor of compounds. It is widely used in the refining and bleaching of vegetable oils and chemical solutions, water purification, recovery of solvents and other vapors, recovery of gold, and in gas masks for protection against toxic gases. On an average 3 tons of coconut shell charcoal would yield 1 ton of activated carbon. The total capital outlay for a unit of 1 Ton/day capacity of finished product would be around Rs 85 lakhs.

#### **Conclusion**

The development of coconut culture and industry in India received impetus with the setting up of CDB in 1981. The Board has been implementing the scheme "Integrated Development of Coconut Industry in India" since its inception. As a result of the integrated approach and the implementation of various programmes of the Board, there has been significant increase in

production and productivity of coconut in the country besides promoting product diversification and by-product utilization. In the production front, availability of quality seedlings has been increased considerably especially, high yielding DXT and TXD hybrids as a result of various programmes implemented by the Board. Adequate infrastructure facilities have also been created in most of the States by establishing Demonstration-Cum-Seed Production Farms and assisting the participating State Government for establishing Regional Coconut Nurseries and promoting seedlings production under private sector by establishing Seed Gardens and Coconut Nurseries. Ensuring the availability of quality seedlings will help in long way to enhance the production and productivity of coconut in the country. The new approach "coconut cluster programme" implemented by the Board has helped greatly in neutralizing the disadvantages of small and fragmented coconut holdings. Strong farmer participation in finalizing action plan, adopting input management and required plant protection measures and promoting coconut based farming systems have induced a sense of responsibility, power of economy among the farmers. Promoting product diversification, commercial exploitation of by-products and waste products like coconut wood and fronds will enhance the farm level income on one hand and the consequent establishment of coconut based industries will provide employment opportunities and livelihood securities to millions of people in the country.