INSIDE

THEME

INTEGRATED COCONUT FARMING

New initiatives for a sectoral shift towards tender coconut & value added products

Dear Coconut Farmers,

This issue of Indian Coconut Journal is focusing on integrated farming in coconut holdings. Board is continuing all the programmes undertaken during 11th Five Year plan in 12th Plan period also. It is planned to carry out developmental programmes through the three tier farmer collectives; Coconut Producer's Societies, their Federations and Producer Companies. Formation of Coconut Producers' Societies and their Federations are in progress in Tamil Nadu, Karnataka and Andhra Pradesh after the successful piloting in Kerala. India which enjoys the premier position in productivity, second position in production and the third in area under coconut, have all the potential to excel in processing for value addition and export of coconut products. Organised efforts for this purpose is needed to ensure a fair, reasonable and steady price to farmers. Price stability in value added products is observed in both national and international markets. Price fluctuation is a regular feature only in case of coconut oil, copra and in raw coconuts. It is high time that farmers must shift from the old tradition of making only copra and coconut oil from coconut. Board is trying for this shift through TMOC. Farmers from all major coconut growing states, farmer collectives and state governments must work in tandem for making this shift possible.

It was decided to conduct investor's meet in all major coconut growing states for initiating processing units for value addition. The first in the series was conducted at Kochi on 2nd November 2012. It was jointly organised by KSIDC, Department of Agriculture, Government of Kerala and Coconut Development Board in association with KAU, CPCRI and CFTRI. Technical sessions on value added products from coconut and sharing of experience by successful coconut based entrepreneurs were motivating potential entrepreneurs. The meet was momentous with the presence of more than 250 participants. A platform was also created for arranging financial assistance through KSIDC and various other banks. Senior officials of six banks participated in the meet offered financial support to entrepreneurs.So far, more than 20 registered entrepreneurs visited Board for post seminar follow up. Availability of suitable land was felt as the most common problem by entrepreneurs. State Government may immediately identify suitable land for the proposed 'coconut bio parks'. If state governments of major coconut growing states extend support to potential entrepreneurs by establishing 'coconut parks' in districts with more than 25000 ha. under coconut cultivation we could accelerate the pace of value addition in coconut. A subsidy of 25% from state government over and above that offered by CDB will surely act as a catalyst.

Similar investors' meet need to be conducted in the states of Tamil Nadu, Karnataka and Andhra Pradesh during this year. Coconut farmers can ensure a better price for their produce only if more units are established for processing and value addition. 'Tender Coconut Growers' Association' (TCGA) of Pollachi has made a remarkable initiative on ensuring fair price to farmers. More than 350 member farmers are now deciding the price of their tender coconuts. They have fixed the price of Chowghat Orange Dwarf (COD) variety at the rate of Rs.17 at farm gate and Rs.15 for other tender nut varieties. Extending such models to all coconut growing states may be thought of as a coping mechanism during price fall. Coconut growers in Andhra Pradesh, West Bengal, Gujarat and Maharashtra are getting Rs.4 to 5 only for a tender coconut while consumers in all metros and cities pay a minimum of Rs.20 to 25 per tender coconut. Inefficiencies and too many intermediaries in the supply chain are considered to be the major factors behind this. Farmer collectives and their federations can act as major players to disintermediate the supply chain to ensure fair and reasonable price to farmers and affordable price to consumers.

As we are part of the global markets, there is every chance of stiff competition from our international counterparts in Asia Pacific region in production, productivity and processing of coconuts. In order to be competitive we have to improve our farming practices, cultivation techniques and adaptation of new technology. Up-to-date information on prevailing market trends and market intelligence must be made

available to farmers through their collectives. Farmers must be aware of the opportunities and challenges before India as a member of WTO. They may be made aware of the prospects of processing for value addition and opportunities for making available our products in international markets. We have to undertake our role along with state governments for educating and equipping our farmers to keep them up to date in the changing world of opportunities and problems.

As India is collaborating with ASEAN countries for more liberalised trade and market access, our farmers especially those who are in plantation sector, need to equip themselves with better productivity, technology and processing facility to cope with tight competition from those countries. Our farmers must be made aware of the farming system and cultivation techniques of ASEAN member countries. We had discussed basic details of coconut cultivation in major ASEAN countries in the previous issues of Indian Coconut Journal. We are number one in productivity, number two in production and number three in area under cultivation, but in processing and value addition we are no where in the first ten positions. We have to move ahead in an organised way in processing and value addition through better technology to lead our nation to the prime position in production, productivity, processing and exports. This is our common mission we have set for the 12th Five Year Plan.

Tender coconut water has an indomitable position in global as well as Indian market. But the processing capacity in our country is negligible at present. Tamil Nadu and Karnataka are planning to set up more tender coconut processing units during this year. Many units have already got assured export orders. More entrepreneurs may be attracted to the tender coconut processing sector through 'Coconut Bio parks'. Board is targeting to have minimum 100 tender coconut processing units during next 2-3 years.

In order to have more tender coconut processing units, farmers must cultivate more tender nut varieties. Maximum possible nuts may be harvested at tender nut stage. Seedlings of tender coconut varieties need to be produced through the joint efforts of CDB, State Agriculture/ Horticulture Departments, CPCRI and State Agriculture Universities. More nurseries may be established in private sectors too. CPSs and Federation can start small scale nurseries for producing tender coconut seedlings. CPSs and Federations formed in one block in Alappuzha district in Kerala are proceeding with target of planting 1 lakh seedlings of tender coconut varieties during next season. The CPSs are going to produce seedlings for this purpose with support of CDB and Block Panchayat. Board has given assurance to make available the required seednuts. Board is already in receipt of request from CPSs for 2 lakh seednuts of tender coconut and dwarf varieties.

The early bearing tender coconut varieties will start flowering from 3rd year onwards. Farmers will start getting income from 4th year onwards and production will be stabilized within 2 years. While cultivating tender coconut varieties as 'under planting', even in existing gardens, old and senile palms can be cut and removed after ensuring steady income from tendernut varieties. A target of 5 to 10 lakh seedlings may be fixed for next planting season. Seednuts can be collected from certified mother palms from farmers gardens and seedlings can be reared by various CPSs. Local Self Government Institutions may be approached for financial assistances. Possibility of availing assistance from centrally sponsored schemes of Horticulture Mission and RKVY may be explored. Coconut Producers' Societies and their Federations must also take up processing units for coconut milk, coconut cream, desiccated coconut, virgin coconut oil and edible copra.

These initiatives are conceived as a primary step to arrest price fall of copra and coconut oil. Let us create opportunity for setting up of thousands of tender coconut parlours through the joint and concerted efforts of central and state governments, various related agencies, and Local Self Government Institutions. The 'undiluted, unpolluted, unpoisoned' natural soft drink - the tender coconut water is going to be the health drink of the future. If we have more and better processing facilities we can surely hope for a quantum jump in production and export of tender coconut water.

I solicit the keen and urgent attention of all farmer friends, CPSs and Federations to this specific area in the coming months.

With best wishes,

T K Jose

Chairman

Integrated Farming in Coconut Holdings for Productivity Improvement-

a Programme which led to Cluster Approach in Coconut Sector

Remany Gopalakrishnan

The programme for "Integrated farming in coconut holdings in Kerala for productivity improvement" had its beginning in an area of 10,000 ha during1987-88 which was the third year of the VII Plan Period. The technical content of the programme was to cut and remove the disease affected, senile and unproductive coconut palms at an average rate of 2.8 percentage of the palm population, and replant with genetically superior planting material preferably hybrids, promotion of irrigation facilities, multi species cropping system and extending technical support including institutional credit to the farmers for adopting different enterprises. Incentive subsidies were envisaged at Rs.75 per palm for cutting and removal, Rs.4 per seedling for replanting, Rs.1000 for irrigation facilities like pumpsets/ irrigation sources and Rs.50 per ha for promotion of multi-species cropping. The institutional support proposed was for the purchase of milch animals and also for starting other enterprises like bee keeping, piggery, poultry etc. Multispecies cropping were envisaged at 60 per cent of the operational area i.e. in 6000 ha . No financial assistance was extended for fertiliser application. The programme was implemented by the Department of Agriculture, through the Panchayat level Krishi Bhavans. Field level staff for the state was also provided for implementing the programme. The total financial outlay of Rs.56.775 lakhs, was to be shared on 50:50 basis by the Board and the State Government. A credit component of Rs. 227.5 lakhs also formed part of the financial outlay of the programme.

The Government of Kerala implemented the programme and achieved the target fully. However, no conspicous impact could be brought out in view of the low targets set in when compared to the gravity of the root wilt disease prevailed in the state. The programme was originally envisaged for four years commencing from 1987-88 to 1990-91. Since the VII plan period was over by 1989-90, there was a spill over year for

implementation. Incidentally the years 1990-91 and 1991-92 were Plan holidays and were treated as Annual Plans. Thus the programme commenced during the VII Plan was completed by 1991-1992 and the scheme was continued in an additional area of 10,000 ha during 1991-92 with the same mode of implementation and pattern of assistance.

Expansion of the Programme

A national seminar on 'Production and productivity of coconut in India' was held at Trivandrum on 27th September 1986 jointly by the Ministry of Agriculture, Government of India and the Government of Kerala. The recommendations emanated from the seminar formed the basis for formulating future production and productivity oriented programmes under the State and Central sectors. By this time the root wilt disease was spread in more than 4 lakh hectares in Kerala. It was however experimentally proved that considerable yield increase could be achieved through adequate management of the affected gardens. The basic requirements identified necessary for maintaining optimum productivity were irrigation, optimum use of manures and fertilisers, cutting and removal of senile, unproductive and disease affected palms, promotion of intercropping, mixed farming etc. These practices not only improve the income and employment from the existing holdings but also enrich the fertility status of soil. The importance of providing irrigation facilities in coconut as a means of increasing the production and productivity even in the disease affected areas was emphasised by the participants in the above seminar. Irrigation facilities would also facilitate intercropping and mixed cropping in the gardens. Therefore an integrated programme encompassing provision of irrigation facilities, replacement of senile and disease affected palms, replanting with quality planting material, optimum use of fertilisers and promotion of multispecies cropping was, therefore felt imperative. Thus the recommendation of the seminar was, to expand the integrated farming scheme which was being implemented by the Board in 10,000 ha to a wider area of 1,00,000 hectares.

A massive programme with coverage of 1,00,000 ha was thus formulated by the Board during the VIII Plan Period which commenced from 1992-93. With the implementation of the programme from 1986-87 to 1991-92 an area of 20,000 ha only could be covered in the state, with a subsidy component of Rs.106.496 lakhs. From the field level experiences gained and the feed back received from the implementation till then, the quantum of subsidy under various components was increased and mode of implementation modified during VIII Plan period. There was a directive from the Government of India to explore the possibility of extending the programme to other major coconut growing states as well. This was in the context that diseases similar to the rootwilt disease in Kerala, like Thanjavur wilt, Tatipaka wilt and Ganoderma wilt were causing damages to the coconut cultivation in Tamilnadu, Andhra Pradesh and Karnataka respectively. Though these diseases were not so widespread, eradicating the foci of infection and thereby arresting further spread of the disease to neighbouring areas was a matter of great concern. Therefore a decision was taken by the Government of India to extend the programme for integrated farming in coconut holdings for productivity improvement to other traditional belts viz. Karnataka, Tamilnadu, Andhra Pradesh, Goa, Maharashtra, Andaman & Nicobar Islands, Lakshadweep and Pondicherry during the VIII Plan period. The technical content remained more or less same as that of the programme implemented during the VII Plan period, excepting the additional inclusion of components like assistance for fertilizer application and plant protection measures. Quantum of subsidy was enhanced to Rs.200 per palm for cutting and removal, Rs. 5 per palm for replanting, Rs. 5 and Rs. 3 per palm for fertilizer use and plant protection and Rs. 200 per ha. for multi species cropping. The programme was to be funded at 100 per cent by the Board instead of the pattern of 50:50 adopted during the VII Plan period.

Irrigation component was, however, kept out of the purview of the programme under the pretext that it would be a duplication of the effort of the State Governments as well as that of National Commission for Plastics in Agriculture (NCPA), Government of India. The implementation of the programme without including the irrigation component was however, a major impediment experienced in the field adoption. The integrated farming programme therefore, could not bring in the expected impact without the irrigation component. The area covered under the programme was 1,36,800 ha of which one lakh was for Kerala.

Direct Implementation by Coconut Development Board

Though the programme was under implementation since 1987-88, the impact of the programme was not yet assessed. Therefore, to make an assessment as to whether the programme had any impact on improving the productivity of coconut holdings, the Board had taken up the implementation directly in selected panchayaths in Ernakulam District, utilizing the then existing manpower. A socio - economic survey for collecting the household details of 11 wards of Kumbalam Panchayat and one ward of Kadamakudy Panchayath was conducted in 1994-95 by engaging 38 enumerators. The survey covered 4945 households in Kumbalam Panchayat and 455 households in Kadamakudy Panchayath. Disease affected/unproductive palms were marked for removal directly by Coconut Development Board. During 1995-96 the cutting and removal of palms and disbursement of subsidy started. Seminars were conducted in these areas to create awareness among the farmers in association and active involvement of Krishi Bhavans, Panchayaths, Kerakarshaka Sangham and Ernakulam Social Service Society. In Moolampilly 438 palms were removed and subsidies amounting to Rs. 87,600 were released. Of these, 431 palms were cut in 1995-96 by disbursing a total subsidy of Rs. 86,200, In Kumbalam, 2925 palms were removed and a total subsidy of Rs. 5,85,000 was released. In 1996- 97 alone, 2104 palms were cut and a total subsidy of Rs. 4,20,800 was disbursed. Planting materials of intercrops were also distributed to farmers to adopt inter cropping in coconut holdings and thereby increasing the income from unit holdings.

Impact of the Programme

An analysis of the productivity increase in the country as a result of implementation of the programme from 1987-88 to 1996-97 is relevant. While the national productivity was 5179 nuts per ha in 1986-87, this could be elevated to 7779 nuts per hectare by the end of the VIII Plan (1996-97). The corresponding figures in case of Kerala were 4493 nuts and 6013 nuts per hectare.

The increase in the national productivity was mainly attributed to the conspicuous hike in the productivity recorded by the States like Andhra Pradesh, Tamilnadu, Maharashtra, West Bengal etc. Though the Integrated Farming Programme was under implementation in these states, the productivity increase might not be from the salutary effects of the programme alone. Exorbitantly higher productivity level existed in certain holdings of many states was a clear indication of the potential for increasing the productivity.

Disease eradication through removal of disease advanced palms was given importance under productivity improvement programme. Number of palms that could be removed under the programme was however quite low when compared to the gravity of the disease intensity. However it was encouraging to note that the intensity of the disease had come down considerably than in the mid 80's. Among the eight districts, in 1985, the highest disease incidence was recorded in Kottayam district, which was 75.63 percent; while in the latest survey conducted in 1996, Alappuzha district recorded the highest disease incidence, but it was only 48.03 percent. While the mean intensity of disease occurrence in the eight districts was 32.37 per cent in 1984, the corresponding figure as per the 1996 survey is only 24.05 per cent. This reduction in the disease intensity could definitely be attributed to the beneficial impact of the programme.

Introduction of Cluster Approach

During the IX Plan period under the integrated farming programme a consolidated financial assistance of Rs.35,000 was approved solely for adopting integrated management practices which was to be disbursed in two years in equal installments. Cutting and removal component was thereafter treated separately. This modification enabled to bring the northern districts of Kerala also under the productivity improvement programme. It also helped eradicate the foci of infection by removing the stray palms located beyond the border districts of Trichur and Thiruvananthapuram.

It was generally accepted that fragmented holdings do not render themselves viable for the optimum utilization of resources and the adoption of improved technologies. To overcome the unremunerative nature of small holdings and to augment the production and productivity of smaller holdings group management of resources is a welcome approach which would help overcome the inherent weaknesses of the fragmented holdings. Due to the highly disorganized nature, impact of development programmes at the field level does not become entirely visible. Transfer of technology is not reaching to the farmers well in time. It was therefore felt essential to create a platform for a group approach for overcoming these problems. Various frontline demonstrations indicated that the yield of coconut can be improved by more than 100 percent through collective approach. This realization led to think of a cluster approach in implementation of integrated farming programme. Thus the cluster programme under integrated farming was introduced on trial basis in 2005-06 in Alappuzha district in limited area with an objective to assess the impact of the programme when the intervention of the Board is direct and more farmer friendly. Taking the success of the programme as the pivotal pointer, the scheme was extended to other districts in Kerala and other potential states through the network of field offices of the Board utilizing the state department machinery as well, in implementation process. The implementation was in contiguous areas of 25ha to 50ha to make the cluster the vehicle for dissemination of technology and adoption of management practices for achieving higher productivity and increased income.

Objectives and mode of implementation of the cluster programme

Reducing cost of production, augmentation of farmer's income, improving the marketable surplus, promotion of value addition through promoting processing, promoting group dynamism, promoting farmer participatory technology transfer and achieving maximum efficiency by harnessing and sharing the strength and wisdom of farmers were the immediately envisaged objectives of the cluster approach. The strategy helped in improving the efficiency of land and water use, adoption of a community approach in plant protection, procurement, application of inputs and raising of intercrops. The clusters will also form the basic unit for primary processing of coconut which will result in enhanced income accruing to the coconut farmers. The cluster involves the participation of nearly 200 farmers and all the farmers become beneficiaries of the programme. This arrangement was an important tool for overcoming the problems associated with scarce resources, fragmentation and dispersion of coconut cultivation and inadequate levels of marketable surpluses. Utmost transparency was assured in the entire implementation which encourages the participating farmers as well as other implementing agencies.

Within each cluster, Chairman, General Convener, Group leaders, and other committee members are selected for easy and smooth implementation by dividing the total cluster area into sub groups of 5 ha each. Community Pest and Disease control programme is carried out against common pests and diseases to reduce the cost. Red palm weevil, a common, but very serious pest, is trapped on group basis using pheromone traps in contiguous areas. Field visits and interactions are done on weekly, fortnightly and monthly basis, which enable easy and quick exchange of

ideas for adoption of technologies. All farmers in the cluster become beneficiaries of the programme irrespective of the area they possess. **The cluster approach has become more acceptable among the farming community and so far 822 clusters in 27725 ha have formed till 2011-12 all over the country. .**

Benefit of the Cluster programme.

Coconut Clusters through group activities ensure profitability of coconut cultivation through assured yield increase and other sources of income. Reduction in cost of cultivation, regular employment, and decline in pests and disease problems are the major advantages. The farmers can fetch higher income by the sale of multiple products like vegetables, fruits, planting material, vermi-compost, milk and other animal products. The reduction in cost of cultivation to the extent of 25% was visible as a result of collective procurement of inputs and group effort in production management. Application of systematic organic and inorganic inputs coupled with regular irrigation enriches the fertility status and water holding capacity of the soil. The input use efficiency in the small homesteads increases manifold. The farmers are able to sell the produce from main crops, intercrops and livestock and can fetch regular income. By consuming the non-saleable or surplus vegetables and animal products, the nutritional status of the family members also improves. Technology adoption becomes a regular practice of the farmers. Ensuring regular supply of produces to the government and private outlets sustains the local markets and marketing activity.

Now the Board is spearheading one step ahead in a revolutionary pathway of forming Coconut Producers' Societies, Federations and Coconut Producers' Companies. The experiment which made a kick start in Kerala in 2011-12 has witnessed 100 per cent success in its challenging journey, and has moved forward to other states. As on today 1761 CPSs and 39 Federations have been formed. The forward and backward linkages among various stakeholders in coconut sector have thus come true and a time is not far away where the coconut farmers' collectives built a strong base with powerful bargaining power and influential voice as never seen before.

Deputy Director, CDB, Kochi-11

Import of Edible Oil 2008-2012 (November to October)

Edible Oil	2008-09	2009-10	2010-11	2011-12	Percentage variations over previous year
RBD Palmolein	1240018	1213409	1081686	1577356	45.82
Crude Palmoil	5187063	5169445	5374333	5993665	11.52
Crude Olein	745	4428	6501	500	-92.31
Sun Flower Oil	590175	630005	803593	1134881	41.23
Rape Seed Oil	46362	13950	11122	90758	716.02
Soybean Oil	989613	1666492	1006691	1079004	7.18
Cotton Seed Oil	5069	9438	0	0	
Coconut Oil	16693	4198	2967	1999	-32.63
Crude Palm Kernel Oil	107622	111973	84566	97903	15.77
Safflower Oil	0	0	0	5400	
Total	**8183360**	**8823338**	**8371459**	**9981466**	**19.23**

During the year 2011-12 import of RBD palmolein has registered an increase of 45.52% over the previous year (2010-11). Crude palm oil recorded an increase of 11.52% during the corresponding period. The total edible oil import during the year 2011-12 has registered an increase of 19.23% over the previous year(2010-11).

Coconut based integrated farming for multiple benefits

P.K.Thampan

Traditional coconut farming, in general, lacks in species multiplicity and functional diversity. Perhaps, the situation in home gardens is similar to that of natural ecosystem but, even here, the replenishment of soil organic matter through organic recycling does not take place at optimum levels. The major reason is that both in home gardens and in larger farming units no part of the coconut biomass becomes available to the soil. Along with coconut, the other components of the biomass such as fronds, stipules, bunch stalk, husk, shell etc. constitute sources of income to farmers and, as such, do not form part of the recyclable wastes in the soil. Coconut gardens in most of the states in India are clean tilled on a regular basis which encourages rapid decomposition of the added and native organic matter leading to impoverishment of the soil.

Among the coconut growing states in India, Kerala is credited with having the longest history of coconut cultivation. Coconut culture in the state has continued since pre-historic times without the benefit of proper cultural management. The land under coconut has undergone a process of degradation as a result of organic matter depletion, inactive soil life and faulty cultural practices leading to soil erosion and water run-off. Perhaps, the impaired soil health and the depleted soil life could be the major contributory factors for the widespread prevalence and virulence of many diseases of coconut palm such as the debilitating root wilt disease, leaf rot disease etc.

Coconut Based Integrated Farming for Ecological Benefits

Integrated farming is a land management system involving a combination of diverse but compatible groups of trees, shrubs, herbaceous plants and livestock including poultry in the same operational holding. The system promotes functional diversity and maximum positive interaction between components. In the

Tree species under coconut

traditional coconut farming, farmers cultivate miscellaneous food crops in the interspaces. When tree species of complementary nature are also introduced, either along the border or in the centre of the palm rows, a system resembling natural ecosystem is created. The tree species close their canopy within a few years and along with the coconut palms and the herbaceous plants available underneath present a multilayered canopy structure which offers protection to soil from extremes of temperature, surface runoff and erosion. The woody components in the system also produce a surface litter layer which is replenished by leaf fall. The litter layer has a profound influence on the physical, chemical and biological properties of the soil. The continuous availability of shed leaves and other organic refuses on the soil surface promotes sustained biological transformations in the soil leading to improvement in soil structure, better availability of plant nutrients and enhanced soil life.

Livestock is a very important component in the integrated farming system. Cattle and poultry contribute to efficient recycling of organic wastes available in the system. When animals are fed fodder collected from outside sources, there is a nutrient flow from different locations to the farm. In a properly organized farming system with livestock as an essential component, there is maximum utilization of organic wastes and their efficient conversion into valuable manure.

In the integrated farming system, the trees and shrubs facilitate nutrient cycling. The nutrients available in the deeper layers of the soil are extracted and transported to the soil surface with leaf litter. In the presence of an abundant supply of fresh organic refuses on the soil surface, the natural diversity of the soil life is stimulated. The population of earthworms multiplies and their enhanced activities improve both the physical and chemical properties of the soil. There is also a closer interdependence between

Vegetables and backyard poultry

Banana and tuber crops under coconut

the roots of higher plants and soil organisms. The continuous availability of root sloughs and exudates sustain an active and diverse soil life in the rhizosphere. When the soil life is enhanced, the disease causing organisms are usually outnumbered by their antagonists making natural control of soil borne pathogens possible.

When nitrogen fixing trees are included in the system, the associated crops are benefited from the nitrogen fixed in nodules on the roots of leguminous as well as some non-leguminous trees. Mycorrhizal fungi are commonly found associated with the roots of nitrogen fixing trees. Mycorrhizal infections increase the mobility of phosphates and other poorly mobile ions such as potash, magnesium, zinc and copper. These nutrients which would have been lost in leaching are retrieved by the tree roots and deposited on the soil surface in the form of leaf litter.

The presence of diverse tree species in the coconut holdings has a salutary effect on the water economy. By acting as wind break and by causing partial shade in the inter spaces of palm rows, the trees reduce evaporation loss of water. They also offer a barrier effect on the surface flow of water during rainy season and thereby facilitate better infiltration. The tree components of the system minimize the hazards of soil and water erosion, stimulate the underlying productive capacity of the soil resource, improve the quality of local environment and strengthen biological diversity. The tree components also function as effective sink for carbon dioxide and many air pollutants, both gases and particulates.

Coconut Based Integrated Farming for Socio-Economic Benefits

Apart from the protective or ecological advantages of integrated farming, the system benefits the farming community in different ways. With the introduction of a variety of crops, farm animals and other enterprises in the system the net returns from unit area, time and inputs increase considerably besides freeing coconut farmers from the risks involved in the cultivation of monocrop. The integrated farms permit the repeated use of organic wastes and by-products and, thereby, help to increase the per capita energy consumption. The system facilitates the production of multiple products and also improves the productivity of coconut palm by stimulating positive interaction between different components. The generation of additional employment opportunities is another advantage. In a state like Kerala where the root wilt disease is rampant in many districts, coconut-based agroecosystem will have positive influence on the health of both the soil and the palm which is likely to stimulate the natural resistance of the palm against disease causing pathogens and/or soil borne pathogens.

Cultural Management in Coconut Based Integrated Farming

In most of the States in India coconut land is clean tilled and kept free of weeds. It is practiced in all soil types adopting different tillage practices. In this process weed growth is completely eliminated and a surface layer of soil mulch is maintained to break the upward capillary movement of soil moisture. In a coconut based integrated farming system it is not a desirable practice to clean till the soil. The maintenance of surface litter as well as weed growth is useful in ameliorating the soil conditions as well as the agroclimate of the holding. Frequent tillage causes mechanical injury to the earthworm population of the soil besides resulting in the removal of all

surface vegetation leading to temperature rise, evaporation loss of soil moisture and depletion of soil organic matter. Surface vegetation, whether it is a pasture, fodder grass or even ordinary weed growth, will contribute to a regular addition of carbonaceous matter to the soil in the forms of sloughs and root exudates for the soil organisms including earthworms to act upon.

For the maintenance of soil fertility in a coconut based integrated farming system weeds are not to be eliminated but only suppressed for deriving maximum agronomic benefits. Normally, weed growth is suppressed under the leaf litter available in an integrated farming system. When the weeds overgrow slash weeding and using the biomass as mulch is the most desirable practice. It is, however, essential to keep the effective root zone of the palm, which lies within a radius of 2 m from the bole, free of weed growth. Mulching the root zone with any locally available organic material effectively checks weed growth. Such cultural practices in coconut holdings would facilitate a natural process of dissolution and synthesis in the soil.

Perhaps, minimum tillage will be required in soils which form hard surface crust on drying. Under such situations tillage breaks the crust, prevents surface flow and facilitates water infiltration. In all other soil types tillage could be dispensed with and the soil left undisturbed. When surface cover of leaf litter and slashed weed growth is maintained along with good organic mulch in the tree basins, the water holding capacity of the soil is improved and surface evaporation is minimized. Consequent to these improvements, it is possible to economize on the use of irrigation water. It has been observed that even in sub-humid and semi-arid regions in India where coconut is grown, the adoption of minimum or no tillage along with the use of organic mulch in the palm basins has resulted in a saving of irrigation water by 50% without any reduction on the level of productivity especially when drip irrigation is practiced.

While the coconut based integrated farming system presents both economic and ecological advantages, it has to be adjusted to the local agroclimatic situation for deriving positive results. In a coconut garden, the growing of other tree species is less likely to offer canopy competition when the palm crown constitutes the upper storey. However, root competition for nutrients and moisture cannot be ruled out in the system. In humid areas where rainfall is plenty and the tree litter are not removed but applied to the soil as mulch or fed to cattle and recycled, root competition could be avoided provided the tree species are planted at least 2 m away from the bole of the palm. However, the situation is different in low rainfall areas where root competition will operate. But in low rainfall belts, coconut palm is generally cultivated as an irrigated crop and when irrigation is adequate, the possible adverse effects of root competition for moisture could be kept to a minimum. Here also the systematic use of tree litter in the garden is essential.

R&D Support for Promoting Coconut Based Integrated Farming

Studies have to be organized in Research Stations to understand the techno-economic aspects of integrated farming in coconut holdings in relation to holding size, agroclimate and local needs. The most appropriate tree species and the optimum tree population in coconut holding have to be determined for different climatic zones. The studies shall also cover the cultural requirements in the system and whether sustainable production at higher levels would need supplementary use of fertilizer inputs. The role of nitrogen fixing tree species in the system and the management needs for deriving maximum benefit from such trees have also to be studied.

A major development project for promoting integrated farming in coconut holdings shall be formulated and implemented with the objectives of (1) facilitating the conversion of monocropped coconut holdings into ecologically and economically stable agro-ecosystems through the introduction of integrated agriculture in which organic recycling or the repeated use of farm wastes is an essential constituent and is also the linking or binding force between each and every practice, (2) identifying the basic needs in each holding and extending techno-economic support for the selection, procurement and management of the essential components of the system covering multispecies cropping, cattle/goat/piggery/poultry/ rabbit rearing, bee keeping, pisciculture etc. and for the integration of biogas production unit, and (3) organizing workshops, trainings etc. for the benefit of the participating farmers as well as the field extension personnel.

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Scope for innovation in farmer's field

V.Krishnakumar

Rural farming communities in developing countries are experiencing various challenges related to their livelihoods and food security, the deterioration of natural resources, the adverse impacts of climate change and volatile prices for agricultural commodities. In order to effectively counter these challenges, newer and innovative methods of farming are very much essential.

Innovations play very important roles in production of agricultural commodities as well as in optimizing resource utilization by farmers. Apart from innovations and scientific package of practices developed and transferred from Research and Development institutes, innovations in the form of grass root level technologies and methodologies developed by some of the innovative farmers and rural youth can also considerably benefit the farming communities in a long way.

However, in many cases, such innovative technologies and methodologies are largely confined to some locations. Benefits accrued from such innovative ideas need to be widely shared across the country through suitable dissemination methods. And the scientific talents behind such grass root level innovations need to be encouraged and recognized. Valuable ideas and techniques generated by them largely go unnoticed owing to lack of proper documentation and opportunities for wider dissemination.

It is in this context that during December 2011, the UN General Assembly has declared 2014 to be the International Year of Family Farming and invited FAO to facilitate implementation of the International Year, in collaboration with its partners. Among its initiatives for the International Year, FAO is planning to publish a major study on family farming and agricultural innovation systems (AIS) in 2014 as part of its State of Food and Agriculture (SOFA) series.

Coconut palm, once starts yielding, is a crop that has potential to give higher productivity based on the agro management practices adopted. Hence, it is very much essential to provide congenial conditions for better growth right from the time of planting onwards. Some of the innovative ideas implemented by farmers in their coconut gardens are highlighted here.

A. Soil moisture conservation and irrigation

Understanding the fact that our mother earth is the largest water holding structure, Shri. Gokulakrishnan from Pollachi has taken up appropriate measures to ensure that ground water recharge is enhanced in his coconut garden. He has found that water soaking trenches help water to be retained in the trenches for some time and allow it to percolate down into the earth, thus preventing run off of rainwater. This also helps to prevent soil erosion and loss of fertile top soil, thereby enhancing the fertility of soil. Trenches of size 1m x 1m and convenient length are made in between coconut rows and dry leaves of various trees and coconut leaves etc. are filled up to three-fourth of the trench. This helped water to collect in the trenches to percolate down. According to him, filling the trenches with dry leaves

Trenches taken in between coconut rows and filled with dry coconut leaves

is very much needed, as otherwise, there will be chances of breeding of mosquitoes.

These kinds of trenches may be made in the entire coconut growing area, thereby by making the garden highly fertile. He has planted banana and cocoa in these trenches for additional income.

In many cases, it was found that farmers adopt flooding their coconut gardens. If more quantity of water is given in a short span of time, there is every possibility that most of it is lost by evaporation and deep percolation going below the active root zone of the coconut palms. In case the required quantity of water is given in a precision way, it not only helps to keep the active root zone moist, and the palms to absorb applied water, but also to provide adequate aeration. Shri. Gokulakrishanan is irrigating his coconut palms through pvc pipes tied around the coconut trunk. This type of irrigation helps not only to provide needed quantity of water to each palm, but prevents water loss and enhance yield of coconut palms to the extent of 60% to 70%. Application of fertilizers could also be done through this method by suitably modifying the irrigation system.*For further details contact: Shri. D. Gokula krishnan, Kovil thottam, Chilakampatti, Pollachi, Tamil Nadu.*

Shri. Gowda, from Hassan a teacher by profession, has effectively employed various structures for water percolation in his 'Suvarna Farm'. The coconut trees are planted at a spacing of 9 m x 9 m. He has constructed 2.5 m wide basins along the coconut trees

Irrigating coconut palm through pvc pipe tied around coconut trunk

in a row. These basins, which have percolation ponds between every two-coconut trees, help to preserve water underground. Sapota trees have been planted between two coconut rows in a straight line with the percolation pond. According to Shri. Gidde Gowda, such a structure conserves both soil and water and also helps to preserve the moisture of the soil in the base of the coconut trees. Through this innovative method of cultivation, Shri. Gowda harvests on an average of 150 to 200 nuts per tree in his farm. *For further details contact: Shri. G.S. Gidde Gowda, Suvarna Farm, Brahmadevara Halli, Nittur Post, Hassan 573219, Karnataka.*

B. Integrated farming

Shri. Babu from Alappuzha has developed a novel method of managing his coconut farm for generating higher income through adopting integrated farming practices. He cultivates banana as intercrop in 1.5 acre area coconut garden. He has started intercropping 100 banana plants during 2005. His approach for income generation was through sale of banana leaves. He has cultivated about 1500 plants even. He cuts the tip of banana leaves early in the morning, when the dew of the previous night keeps the leaves clean, free of dust and other impurities, restricting the length to about 30 cm, thus facilitating maximum area for photosynthesis in plants. This, according to Babu, has not at all affected the yield of bunches, and on an average he could harvest bunches weighing 18 kg. Banana leaves is sold to nearby catering units @Re.1 per leaf and he could earn around Rs.2,000 per week.

Another innovative approach adopted by Babu is rearing of ducks. The shed is made at a height of 3 m directly over a natural farm pond extending in an area of 22 cents, where pisciculture is practiced. This helps the ducks to experience comfortable conditions inside the shed and always keep it very clean. The faecal matter of ducks inside the shed, when cleaned by washing, drops down into the pond and act as feed for the green plants growing in the pond. Such plants, according to

Babu, help to increase the oxygen content of water inside the pond, thereby provide suitable environmental condition for the fishes to grow. The same pond is also used for the ducks to swim. Azolla cultivation is also practiced by him to serve as feed for duck, fish and poultry birds. As an active member of "Kairali Purusha Swayam Sahayaka Sangham", Babu is a model farmer of the area and could inspire confidence among the other members to venture into agriculture and allied activities. He has won the "Karshaka Sreshta Award-2011" of Alappuzha district, in recognition of his contributions in integrated farming. *For further details contact: Shri. M. Babu, Thekke Kalathattel, Govinda muttom (P.O), Kayamkulam, Alappuzha district.*

Saji in his nutmeg garden

Top worked nutmeg tree

Shri.Saji from Kozhikode has successfully identified a superior clone of nutmeg after 10-15 years of toil from his farm through analytical and innovative observations of 100 seedling progenies raised as mixed crop in his coconut garden for many years. This superior clone with 10 g seed and 3 g mace are highly preferred in market. Compared to the price of Rs. 180 and Rs. 600-750 for seed and mace, respectively for the local varieties, the newer clone could fetch a price of Rs. 260 and Rs. 1,120 per kg. Average weight of seed and mace of this improved variety was found to be 8-10 g and 2.5 to 3.0 g, respectively. He has christened it as "NOVA", after his daughter.

Rearing ducks in shed above the fish pond

With the quality superiority and yield of above 2,000 fruits at the age of 8 years of NOVA, he has successfully converted all low yielding trees in his garden by the method top working, which he has perfected. According to Shri. Saji, the best period of top working is from October-November to get maximum success. Presently, 100 budded nutmeg trees in various groups varying between 1-12 years are available in his garden. He maintains 1-2 male branches at the bottom in most budded trees to ensure better pollination and fruit set. Shri. Saji has sold more than

1500 grafts in the last 6-7 years in addition to about 2500 bud wood in 5 districts in Kerala covering more than 100 farmers. *For further details contact: Shri. Saji Mathew, Kadukammackel House, Kallanode (P.O), Kozhikode district.*

C. Organic farming in coconut

Shri. Ravi of Eco farm cultivates his coconut garden extending to about 70 acres in an organic way. Some of the palms grown by him belong to the Sri Lankan Dwarf variety. By utilizing the entire organic biomass obtained from the garden, Shri. Ravi prepares vermicompost in the farm itself. Around 10 t vermicompost is produced every month, which is applied @ 60 kg per palm per year. He maintains 75 cattle in the farm for which fodder grass is cultivated exclusively in six acre area in the farm. Coconut leaves are used to put in trenches made in between coconut palms. Coconut harvesting is done once in 45 days through contract climbers. On an average, the productivity is about 180 nuts per palm. He has dug seven tube wells and two common wells in his farm for irrigating the palms. The entire farm is divided into different blocks and irrigation is done for each block separately. Each palm can be irrigated within one hour. Almost all the farm operations are mechanized by Shri. Ravi. *For further details: Shri. Ravi, V Eco farm, Sainthan Palayam, Coimbatore district.*

Shri. C.M. Mohammed's 4 ha farm with its multi-cropping pattern and processing of farm produce and value-added marketing of outputs have great relevance in the contemporary agriculture situation where many farmers stumble in the market place. Shri. Muhamad prepares various kinds of organic manures in the farm itself. EM-2 and EM-5 solutions, needed for keeping the plants healthy are prepared by Muhammad himself. He has found that spraying diluted EM solutions help protecting plants against pest attack. A preparation made by using eggs of local breed of poultry, lime and jaggery also help to improve plant growth. Their innovative approaches in maintaining their coconut garden has brought them the Karshakasree Award (2008). *For further details contact: Shri. C.M. Mohamed and Smt. Shakeela Mohamed, Mandayappurathu Chundan Veedu, Tirur, Malappuram district.*

Shri. Suryanarayanan from Palakkad cultivates 18 acres of coconut farm by adopting organic farming practices for almost 20 years by now. Weeds are allowed to grow to a height of about 75 cm, and then they are beaten down. Coconut fronds are placed over the weed layer and allowed to decompose. This practice is done two times each year. In this manner, it is experienced that different types of grasses add P and leguminous plants add N and other species of weeds add K to soil. Since sunlight is not falling directly on soil surface, this method will also prevent loss of soil moisture in the coconut garden. He has also adopted placing coconut husk in the field, and over a period of time, the entire garden is completely covered. This practice also helps conservation of soil moisture and prevents soil temperature build up and soil loss through erosion during heavy rainy period. The innovative mind of Shri. Soorya Narayanan was suitably rewarded with the Kera kesari award (2004-05) of the Govt.of Kerala. *For further details contact: Shri. K. K. Soorya Narayanan, Kakkattil House, Mamkurissi, Mankara, Palakkad district.*

At a time when some of the coconut farmers removed coconut palms for cultivating rubber, Shri. Dominic from Kozhikode did not follow their footsteps, but went ahead with new planting of coconut. He gave a wider spacing of 12 m for the planting in new area to

Weeds beaten down for decomposition

Shri. Dominic in coconut garden, which gives yield three years after planting

accommodate intercrops at a later period. He used JCB for making pits of 3 m diameter and 1m deep. Though higher cost was incurred, he felt it necessary to make such pits to enable coconut seedlings to establish faster and start yielding early.

Shri. Dominic used his own seedlings for planting in a small mound made on the top of filled up pits. Though the regular practice is to use one year old seedlings for planting, he used those seedlings which were first sprouted in the nursery (i.e about 90-100 days after sowing of seed nuts). Adopting regular agro management practices like manuring and providing irrigation right from the first year of planting has resulted in early flowering (during the third year of planting)and yielding of such palms. The pits are widened by cutting the sides every year and the plants start yielding by the time the pits are sufficiently widened.

Only organic manures are applied in the entire farm. Manuring is based on the yield potential of each palm, more manure for higher yielding palms. During April-May, 40 kg vermicompost or dried cow dung is applied for each palm. As second dose during October, 5 kg mixture of bone meal, ground nut cake and neem cake is applied. This is alternated with the application of ash and tea-waste collected from various hotels nearby. The husk placed in the palm basin is pushed to the outer during SW monsoon period (which facilitates root proliferation) and placed back after application of second round of manures during October. This also prevents drying up of roots during drier months.

Shri.Dominic also follows mixed farming in his coconut garden by raising cows, poultry, goat, duck and fish. Cow dung is used for making biogas as well as for applying to crop plants. He is cultivating colocasia in the basins of a few coconut palms near to his house. He adopts a novel method of harvesting of colocasia. The harvesting is not done by uprooting the plant completely, but rhizome is harvested as and when required, thus retaining the plant in the basins for future need.

He is the president of Haritha Coconut Producers' Society, Anakkampoyil, registered with the Coconut Development Board. He is the recipient of Kera Kesari award of Government of Kerala (2009-10) for his innovative approaches in coconut cultivation. For further details contact: *Shri. M. M. Dominic (Pappachan), Mannukuzhambil Veedu, Anakk ampoyil (PO), Thiruvampady, Kozhikode district.*

Shri. Sajeev 43, a business man cum farmer from Thrissur district maintains his coconut farm by adopting scientific methods of farming, his emphasis being on organic cultivation. He follows mixed farming and also grows a variety of fruit plants in his garden. As the coconut plants were planted in a filled up area, the basic soil fertility was very poor. In order to improve the fertility level, Shri. Sajeev adopted intercropping elephant foot yam in his coconut garden. The innovative approach was filling each pit with lot of organic manure as cow dung and composted coir pith before planting the yam, which helped to improve the nutrient supplying capacity of soil. He maintains around 450 yielding coconut palms which include Malayan Yellow Dwarf, Chowghat Green Dwarf and D x T hybrid palms. He harvests on an average 130 to 140 nuts from each palm. *For further details contact: Shri. Sajeev Antony, Aynikkal House, Kundoor (P.O), Mala, Thrissur district.*

D. Value addition

After retirement as Deputy Tahsildar from the revenue department, Shri. Sebastian from Kasaragod district served as the National Vice President of INFAM, championing for the cause of farmers. The innovative invention of Shri.Sebastian is the production of wine from tender coconut named "tender coconut wine". The ingredients are tender coconut water or tender coconut water and its soft kernel mix collected from farm fresh tender coconuts of seven months ripe or less, and various other ingredients. Tender coconut wines need a fermentation period of 10-28 days. For optional fortification, Shri. Sebastian adds cashew apple alcohol or any such alcohol. As garden fresh tender coconuts are devoid of wild yeast and bacteria, the wine made of it, will be automatically pure and

natural. The tender coconut wine is devoid of any artificial agents and can be the purest drink as it does not even contain natural water as found in other wines. The wine is also highly healthy, hygienic and nutritional beverage.

Shri. Sebastian, recipient of Kera Kesari award of Government of Kerala for 1998-99, has got an Indian patent (No.209015) for developing the coconut wine from tender coconut and tender coconut water during August 2007, which is the first time in the world that any one is getting such a patent. His patent application is being processed by European Union, the US, Canada, Indonesia and the Philippines. *For further details contact: Shri. Sebastian P, Augustine, Palamattom (P.O), Bhumanadi, West Eleri, Kasaragod district.*

Shri. Thomas George a 50 year old "farmer-scientist" from Chemperi of Kannur district. The most important product he has invented is coconut-milk curd, which is under the patenting process after being registered for patent in 2008. Coconut-milk curd looks and tastes like milk curd and yet contains all the health benefits of coconut milk. He is presently attempting to make ice cream and vinegar from coconut milk. Unlike Neera, also called Sweet Toddy or Palm Nectar, which is the sap extracted straight from the coconut palm inflorescence by skilled workers, according to Shri. Thomas, the coconut-milk variant can be made in the kitchen and is expected to be a boon for coconut growers and neera lovers. *For further details contact: Shri. Thomas George, Chemberi, Kannur district*

D. Coconut climbing devise

Though the need for a more convenient and long-lasting solution to the problem of coconut tree climbing was felt by many, the innovative approach of a farmer in Chemberi made a revolution in the field. Shri. Joseph Appachan's family had been in coconut farming business for generations. This innovative farmer thought ahead of his time and foresaw the shortage of coconut climbers. In 1984, the innovative mind of Shri. Appachan, along with his 20-year-old son, imagined a machine that could make coconut tree-climbing easy and self-sufficient. Together, they developed the 'coconut tree climbing device'. Over time, this father-son duo managed to turn this invention into a full-fledged product.

Appachan's son further patented many modifications to the device. With the support from various organisations including the National Innovation Foundation, the coconut tree-climbing model has become instantaneously popular in villages across south India. Even though many modifications to the original machine have been done by many agencies, the old model is very much preferred by most of the coconut climbers, amply showcasing the wide acceptability of the innovation by an ingenious farmer. Coconut Development Board through its "Friends of Coconut Tree" programme has also popularised the Chemberi coconut climber. *For further details contact: Shri. M.J. Joseph Appachan, Chemberi, Kannur district*

Principal Scientist (Agronomy), Central Plantation Crops Research Institute, Regional Station, Kayamkulam

Path cleared for legal status for CPFs

Coconut Development Board had formed farmer collectives at grass root level called Coconut Producers Societies (CPS) comprising of 40 to 100 farmers. CPSs are registered entities under Travancore Cochin Literary and Scientific Societies Act 1956 in South and Central Kerala and under Indian Societies Act 1860 in Malabar region. As a further integration, 15-25 CPSs were associated to form Federation of CPSs called Coconut Producers Federation (CPF). CPFs had been envisaged to be registered entities under Charitable Societies Act but registration was not done at the respective district registrar offices due to the lack of clarity in the membership of CPF.

The Travancore Cochin Literary Scientific and Charitable Societies Act defines the member as a person. Since CPSs are members of CPF and are association of farmers, ambiguity hindered registration of CPF. Coconut Development Board took up the matter with Inspector General, Registration, Government of Kerala and have obtained approval from the Inspector General, Registration for CPF.

Inspector General, Registration has clarified vide GO. No. 20411/ E2/2012 dated 10.10.12 of Government of Kerala that 'Person' shall include any company or association or body of individuals, whether incorporated or not.

Coconut Based Farming System- a money spinner

Jnanadevan R

Integrated farming system in coconut holdings is an interactive practice in which integration of coconut farming with suitable inter/ mixed crops, livestock and other allied enterprises are undertaken with the aim of increasing income. The production alternatives can be a single intercrop, a mixture of crops, or a crop/ livestock combination which are compatible with each other and other environmental factors. One of the most common farming systems practiced by coconut growing traditional farmers is the coconut-based farming system (CBFS). This is a multiple cropping or crop/ livestock production system aimed at maximizing or complementing the benefits that can be derived from coconut. Different crop combinations are recommended by research to suit the availability of resources, sunlight, rainfall, irrigation and soil characteristics.

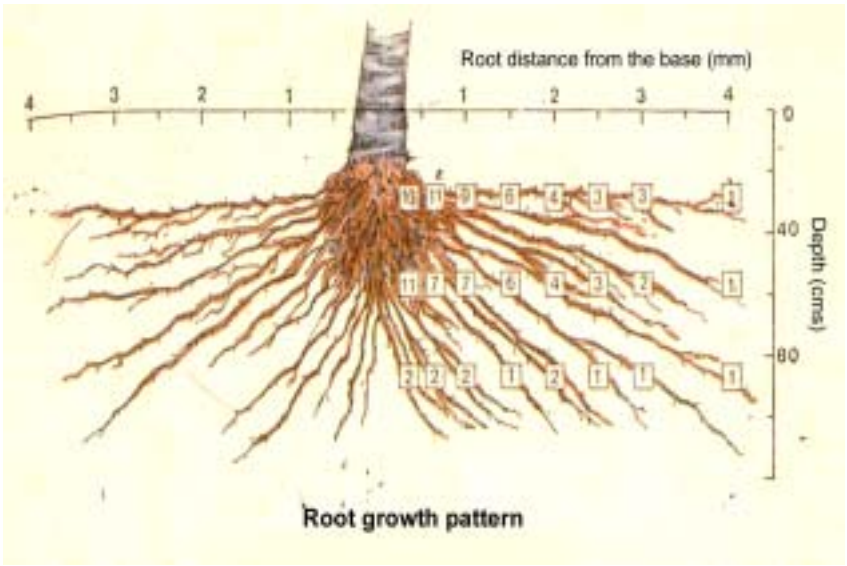
It ensures optimal utilization and conservation of available resources and effective recycling of farm residues within the system. Coconut being a voracious feeder removes large quantity of nutrients from the soil for its growth and production of numerous energy giving materials. A bearing palm producing 50 nuts per year removes 390g nitrogen, 100 g prosperous and 1 kg potash in each year. Since almost all parts of 'Kalpavriksha' are used, chances of recycling biomass from coconut are less. Hence regular application of manures is essential, especially in the traditional areas to compensate this and to maintain the soil fertility at optimum level for sustainable coconut production.

Coconut based integrated cropping systems enable better utilization of natural resources and improves the soil fertility due to the continuous biomass addition by the subsidiary crops. Hence it is recommended as one of the management practices to increase the productivity of coconut by enriching the soil fertility and also for generating higher income from unit holdings. 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.

Why coconut holdings are ideal for Integrated farming system.

Rooting pattern

Coconut palm, like other monocots, has a typical adventitious root system. Under favorable conditions, as many as 5,000 to 8,000 roots are found in the middle aged palms. About 74 per cent of the roots produced by a palm under good management do not go beyond 2m lateral distance and 82 per cent of the roots are confined to 30 to 120 cm depth of soil. A spacing of 7.5 m in the square system is recommended for coconut (175 palms/ha) for optimum production. In coconut garden planted with this spacing the active root zone of coconut is confined to 25 per cent of the available land area and the remaining 75 per cent of the planted area left unutilized could be profitably exploited for raising subsidiary crops.



Root growth pattern

Canopy structure and light utilization

The venation structure of the coconut crown and orientation of leaves allow part of incident solar radiation to pass through the canopy and fall on the ground. The space utilization of coconut is very low and plenty of sunlight falling on the ground remain unutilized. In an intercropping system, light is the main limiting factor for the growth of the intercrop since light penetration of a plant is reduced through interception and absorption by the taller canopy plants. As much as 56 per cent of the sunlight is transmitted through the canopy during peak hours (10.00-16.00 hrs) in palms aged around 25 years. The diffused sunlight facilitates growing a number of crops in the interspaces. Based on the growth habit of the palm and the amount of light transmitted through its canopy, the life span of coconut palm could be divided into three distinct phases from the point of view of intercropping. Planting till full development of canopy (up to 8 years) good light transmission initially. with suitable for growing intercrops with minimal competitions. young palms (9-25) years) with maximum ground coverage (80%) and low canopy due to shorter trunk; poor light availability is not suitable for growing of other crops in the interspaces. Grown up palms above 25 years facilitates gradual increase in the magnitude of light penetration to the ground and decrease in apparent ground coverage of canopy are ideal for raising annual / perennial crops.

Criteria for selection of subsidiary crops.

Crops should be selected according to their shade tolerance and amount of solar radiation available. It should not grow as tall as coconut and should not have an economic life longer than the main crop. Availability of resources like rainfall, irrigation facilities, soil characteristics, labour, farmers needs and market demands are the factors to be considered while selecting the crop combinations in a coconut based cropping system.

Coconut-Nutmeg mixed system

Nutmeg is a money spinning cash crop which requires filtered sunlight of coconut garden and constant care and moist soil in summer months. It is one of the most remunerative crop mix for irrigated coconut garden. Two year old nutmeg grafts are planted the centre of four coconut palms at a spacing of 7.5m x 7.5m accommodating 175 plants per hectare. It is preferable to use grafts prepared from high yielding female trees because of the dioeceous nature of the plant. While planting, the ratio between male and female grafts is to be kept 10:1 pits of 60 x60x60 cm size may be taken and filled with a mixture of farm yard manure or compost and top soil. Fertilizers @ 20g N, 18g P_2O_5 and 50g K_2O ha to be applied in the first year. The dose has to be gradually increased so as to reach 500g N, 250g P_2O_5 and 1000g K_2O per tree per year by the fifth year. Nutmeg flowers at 5-8 years of age and full bearing comes at 15-20 years. Fruits are to be harvested when they have split and when it turn bright red in colour. The mace is dried in the sun for 10-15 days, till it become brittle and turn yellowish brown from the initial red colour. The nuts are dried till the kernel rattles within the shell. On an average, 1500-2000 fruits per tree will be obtained which comes to 8-12 kg nuts and 1.5-2.0 kg mace. With the present market price (Rs.600/ kg for nuts and mace Rs.650/- a kg) an additional income of Rs.1 to 1.50 lakhs, per acre can be obtained by incorporating this crop in the coconut based farming system.

"I have seventy yielding nutmeg plant in my 1.25 acre coconut garden that too is affected by root wilt disease. My nutmeg plants are about 15 years old and yielding regularly and I got an additional income of Rs.1.50 lakhs last year" says Shri. Joseph, a very enterprising farmer from Poovathussery in Ernakulam district of Kerala." I am spending Rs.25, 000/-only in a year for the maintenance of my nutmeg crop including cost of inputs for getting the above income. I am of the view that partial shade in coconut garden with irrigation is ideal for nutmeg cultivation, but plants do not perform well under too much shade. I am applying poultry manure, cow dung and goat manure as organic manures and 1.00 kg potash per plant. I am also irrigating the plants regularly during summer."

Coconut-Cocoa mixed system

Cocoa an ideal, mutually beneficial mixed crop for coconut garden has been proved to be highly remunerative with less cost. One year old F1 hybrid cocoa is planted at a spacing of 3m between plants in a single row system in between two rows of coconut palms. In a coconut garden with palms spaced at 7.5m x 7.5m, about 500 cocoa plants can be

accommodated. The distribution of roots of these crops show that they did not overlap. Cocoa has tap root system. Most of its roots lay within a radius of 80-100 cm laterally at 15 cm. depth in the surface soil. This system requires irrigation during summer months. Recommended dose of fertilizers are to be given to each of the component crops. Regular pruning should be done from the second year onwards to give better shape to the canopy when it is grown as mixed crop with coconut. First tier should develop at 1m to 1.5m ht. and one healthy chupon shoot may be allowed to grow. Additional chupons arising from main chupon are to be removed periodically. Vertical growth is to be limited to single tier. Drooping fan branches may be cut off during Dec-Jan & July- August. On an average 60 fresh pods per tree are obtained every year. 30 pods give 3.0 kg wet beans and 3.0 kg of wet beans give 1.0kg of dry beans.ie on an average 2 kg. wet bean per plant. With the present market price an additional income of Rs.50,000/-per acre can be obtained from this crop.

"I am getting Rs.5000/- per week during peak harvest season from my 200 cocoa plants in 1.5 acre coconut garden" says Shri.P.T. Jose, Pasukkadavu, Maruthakara Panchayat of Kozhikode district. "I got Rs.1.20 lakhs from my cocoa plants during last year when price was ruling very high. Now the price has decreased to Rs.120 per kg. but still it is a remunerative crop as the cost of production is less compared to other crops".

Coconut -Clove mixed system

Clove can be grown as a remunerative mixed crop in coconut gardens in fertile, well drained soils with assured irrigation. It is planted at the centre of four coconut palms. Two year old clove seedlings may be planted in 60cm x 60cm x 60cm pit filled with a mixture of top soil and 15kg farm yard manure or compost. In one hectare of coconut garden, about 150 clove seedlings can be planted. During the first year, fertilizers @ 20g N, 18g P_2O_5 and 50g of K_2O per tree is to be applied. The dose is gradually increased so that the adult dose of 300g N, 250g P_2O_5, 750g K_2O is supplied in the fifth year. Fertilizers are supplied in two equal splits in May and September. Clove starts flowering at the age of six and reaching full bearing at the age of 20. The flower buds are harvested when they turn light pink from green. Flower buds are dried in sun for 4-5 days till they turn brown in colour. An average yield of 3 kg is obtained from a tree per year. An additional income of Rs1.20 lakh can be obtained from one acre coconut–clove system with the present market price of Rs.700/- per kg.

Coconut - cocoa mixed system

Many crops which were grown only in the open space exposed them to direct sunlight are now finding comfortable occupation under coconut garden. One among the same is Cashew. "The common belief is that cashew will come up well only in open space but I have no land to leave vacant. I have successfully grown cashew in my coconut garden." says Shri P.V.Koran, another enterprising farmer of Pallikkare, Kasaragod District. The hardy cashew crop is sucessfully grown as mixed crop in his widely spaced coconut garden. Since he is not having any vacant land, he planted 30 hybrid cashew (Dharasree) in his 0.70 acre coconut garden. Six month old cashew grafts was planted in between coconut trees where sufficient sunlight is available. He claims that the grafts started bearing from the second year onwards. Now the plants are at the 4th year and he is getting 2kg cashew per tree. He is expecting 12-15kg /tree when it reaches full bearing stage. Several farmers in Kasaragod district of Kerala now started growing cashew as a mixed crop in coconut house

Nutgmeg grown as intercrop with coconut

Dharasee - Hybrid cashew variety

holdings. Pruning of the plants from 2nd year onwards during May-June at the onset of monsoon for better shape and size of the canopy is most important for mixing cashew with coconut garden. Removal of lower side shoots / branches up to a height of 1m should be done. Side shoots below the graft joint should be removed periodically. The lower branches should be removed so that the clear trunk up to a height of 1m may be attained after 4-5 years after planting. An additional income of Rs.40,000/- per acre can be obtained from cashew with the prevailing market price (Rs.70/- per kg of raw nuts.)

The experience of these farmers indicate that there is wide scope for promoting high yielding early bearing cashew varieties like Dharasree and Dhana alongwith coconut as a mixed crop.

In Kerala other crops like tapioca, elephant foot yam, colocasia, greater yam and lesser yam are the tropical tuber crops cultivated as intercrops in coconut garden. Presently there is high demand for medicinal plants, as natural herbs used in the preparation of ayurvedic medicines. Crops such as lemon grass, kacholam, dioscorea, arrowroot, sida, thippali (long pepper), neela amari and adapathiyan are suitable as intercrops in Indian condition in coconut gardens. In Kerala intercropping with medicinal and aromatic plants is nowadays a common practice and has been found remunerative.

Financial assistance is extended to farmers under National Horticulture Mission for the development of cocoa and cashew plantations with clones of high yielding varieties of cashew and F1 hybrid seedlings. The rate of assistance is Rs.20,000 per ha (85% government of India share and 15% state government share) by the Central and State government. The scheme is limited to a maximum of 4 ha per beneficiary is extended for undertaking of new planting. The financial assistance is extended for a period of 3 years i.e. Rs.12,000/- (10200+1800) in the first year and Rs.4000/- (Rs.3400 + Rs.600/-) in the second and third year is extended under the scheme. The scheme is implemented by Directorate of Cashew and Cocoa Development and by State Horticulture Mission on cluster basis through the field level officers of concerned state Horticulture/ Agriculture departments and selected NGOs.

Coconut based farming system render enhanced employment opportunities, make available multiple farm produce and ensures ecological sustainability. The beneficial effects include improvement in soil fertility status, increased microbial activities, higher interception of sunlight, better micro-climate and reduced weed growth. Deleterious effects of surface run off and soil erosion will also be reduced in this system. The litters from the falling leaves and other plant parts have a salutary effect on the properties of soil through the degradation process and related activities undergoing in the soil. Experimental results from various coconut based cropping systems show that the high level of productivity could be sustained with lower level of fertilizer input which is one of the most costly input for farming. Coconut based integrated farming system as described above not only provides additional income but also would help achieve higher productivity of coconut on a sustainable basis.

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Organic farming in coconut – feasibility, technological advances and prospects

George V. Thomas, V. Krishna Kumar, P. Subramanian, Murali Gopal and Alka Gupta

1. Introduction

Organic method of cultivation by the use of natural and renewable resources is the best option to ensure soil, air and water around us unpolluted keeping the environment safe for the present and the future generations. Organic production systems are based on specific standards precisely formulated for food production using natural resources and aim at achieving agro ecosystem productivity, which are socially and ecologically sustainable.

2. The basic concepts of organic production on agricultural holdings

Organic agriculture follows the logic of a living organism in which all elements (soil, plant, farm animals, insects, the farmers etc.) are closely linked with one another. Organic farming, therefore, must be based on a thorough understanding and appropriate management of these interaction and processes. Organic farming relies heavily on soil management techniques (e.g. mulching), various cropping systems (e.g. inter cropping), agro forestry (where woody perennials are grown in association with crop/livestock) and recycling of on farm waste resources (e.g. manure, fodder, organic wastes etc). It is also concerned with correlating the number of animals kept on the farm and the available land area so that the farm can cover its feed and soil nutrient need from within the system. Organic cultivation also relies upon adoption of various other means of pest and disease management practices including cultural, mechanical and biological measures than use of synthetic chemicals.

Organic farming is often understood as a form of agriculture with use of only organic inputs for the supply of nutrients and management of pests and diseases. In fact, it is a specialized form of diversified agriculture, wherein problems of farming are managed using local on farm resources to the extent possible. One of the basic principles of soil fertility management in organic systems is that plant nutrition depends on 'biologically-derived nutrients' instead of using readily soluble forms of nutrients supplied through fertilizers and the idea should be to feed the soil to make it living rather than feeding the plants. The major mistake committed over the years was to consider and treat soil as non-living entity which in reality is a living one, harbouring highly diverse population of micro flora and micro fauna. These organisms mediate organic matter and nutrient transformations, making them available to plants in a sustained manner and are inevitable in maintaining healthy soil for healthy crops.

3. Coconut – a crop highly amenable to organic farming

Unlike other field crops, there is no critical stage for nutrient requirement of coconut palm. Since the palms produce a spadix in the axil of each leaf, the yield depends on the number of leaves produced per year. Vegetative as well as reproductive growth goes on simultaneously and hence nutrition is important all the time. Coconut palms export nutrients to the above ground parts continuously from a limited volume of soil throughout its existence. Any deficiency of nutrients at any stage will adversely affect vegetative growth and will directly reflect on yield. It is, therefore, essential that a nutritionally rich environment is provided in the root zone of coconut all round the year to realise adequate yields.

The growth habit and planting methods of coconut make it highly suitable for managing through organic farming. About 74 percent of the roots produced do not go beyond 2 m from the bole and most of the roots also confine to the 30 to 120 cm depth thus utilizing only limited extent of land area for growth of palms. The orientation of leaves in the coconut crown helps penetration of sunlight into the soil and provides opportunities for

exploitation of land and solar energy for inter/mixed cropping. Such an approach will also add large quantities of organic wastes to the system and their recycling within the system makes it productive even in the absence of external inputs.

3.1. Technological advancements in organic farming of coconut

3.1.1. Soil health management and crop nutrition

Organic manures are important in sustaining soil fertility and productivity especially with a perennial crop like coconut. Application of organic matter like tree leaves, cattle manure etc are practiced traditionally for coconut. However, due to the non-availability of land exclusively for cultivating green manure crops and also the limited supply of cattle manure for use as organic manure, organic manuring is seldom practiced in coconut cultivation. Research efforts have resulted in development of technologies based on organic and bioinputs for nutritious and soil health management.

3.1.2. Coconut basin management with nitrogen fixing legumes

Nitrogen fixed symbiotically by legume-rhizobium association can form an important source of nutrients and organic manure for coconut palms. The basin area of 1.8 m radius around the bole of coconut palm generally is left unutilized by most of the farmers for any other purpose. Leguminous green manure crops such as *Pueraria phaseoloides, Mimosa invisa, Calopogonium mucunoides* and *Vigna unguiculata* can be successfully raised in coconut basins. The biomass production and nitrogen contribution by green manure legumes and their influence on soil fertility parameters vary with soil type, climatic factors and type of green manure raised. On an average they produce about 15-20 kg green matter/basin and their incorporation can contribute around 100-150g nitrogen/basin and other major nutrients as well as enhance the population of specific groups of beneficial micro organisms (bacteria and nitrogen-fixers) in the basin thereby improving the soil fertility. The significant increase in the population of micro organisms and the enzymatic activity modifies the soil environment for the benefit of palm growth.

The method of cultivation of green manure in coconut basin is simple, inexpensive and can be adopted even by small farmers. With continuous cultivation of legumes, it is possible to augment soil organic matter resources for sustaining soil fertility and improving coconut yield. Sow the green manure seeds during May-June around the palm basins and uproot when one or two plants start to flower and incorporate the biomass. The nutrient level increases considerably as the biomass start decomposing.

3.1.2. Glyricidia alley cropping in coconut for biomass generation

Generation of large quantities of nitrogen rich biomass is also possible through the cultivation of the fast growing perennial leguminous green leaf manure tree crop, *Glyricidia* in the coconut plantations. This can be very well grown along the borders of coconut plantation and can generate adequate amount of nitrogen rich green leaves. It can also be raised in littoral sandy soils where no other green manure can establish. The tree is propagated either through vegetative cuttings or seeds. One meter long stem cuttings or 3 to 4 month old seedlings raised in poly bags/raised beds can be used for planting. It is preferable that the planting season coincides with the monsoon (South West / North East monsoon) for better establishment. Spacing of 1 m x 1 m can be adopted. Two rows of glyricidia can be planted along the boundary of coconut garden in a zig

Green manure crops grown in coconut basin

zag manner. Plant stem cuttings or seedlings in an upright position in pits of 30 cm^3. For better establishment, a basal dose of 50 g of rock phosphate per pit may be applied. Height of the plants should always be maintained at 1 m by pruning. Pest and disease of glyricidia is not a major problem and hence, no plant protection measures are required. Pruning can be started one year after planting and should be done at least thrice a year (February, June and October). Studies conducted at CPCRI has indicated that the best growth and biomass of leaves could be obtained with planting of three rows of Glyricidia(at 1x1 m spacing between two rows of coconut) and pruning of leaves during February, June and October. This could produce around 8 t of biomass in one hectare of coconut garden. Application of Glyricidia prunings from the interspaces of one hectare of coconut garden to palms could supply around 90%, 25% and 15% of the requirement of N, P and K, respectively.

3.2 Incorporation in the soil of organic materials composted (on farm) or not from the holdings (off farm)

3.2.1. Availability of organic residues in coconut gardens

The availability of waste biomass from a well-managed coconut garden with 175 trees/ ha has been estimated as 14 to 16 tonnes per hectare per year in the form of leaves, stipules, spathe, bunch waste and husk. A considerable portion of husk is used for extraction of coir fibre. The by-product of coir processing factories, coir pith is usually dumped without any use. It has been estimated that 7.5 million tonnes of coir pith is available in the country from the various coir defibering units. The total availability of waste biomass from 1.94 million hectare of coconut plantation in the country has been estimated as 15.4 million tonnes annually. The natural decomposition of these wastes and the nutrient release are very slow due to the high lignin content and the nature of lignocellulose complex of the coconut waste materials. If they are recycled fully, this waste-biomass can meet a major portion of nitrogen and a part of other nutrient requirement of crops. Recycling of coconut waste biomass is possible without affecting the prospects of husk or shell based industries. It also helps to replenish the nutrients exhausted by the palms internally without depending on the external sources.

Alley cropping of gliricidia in coconut

3.2.2. Vermicomposting of coconut palm wastes

Vermicomposting involves using native species of earthworm (*Eudrilus* sp.) for conversion of biomass into useful compost. Vermicomposting can be easily done *in situ* in coconut plantations using coconut leaves and other biomass including wastes from intercrops especially from banana. *In situ* recycling of coconut wastes by vermicomposting in trenches dug in interspaces of four coconut palms yield on an average recovery of 70% in a composting period of 90 days. The average nutrient composition of the vermicompost recovered will be around1.2-1.8 % (N), 0.1-0.2 % (P) and0.2-0.4 % (K), organic carbon (17.84%), and C/N (9.95:1.00). Total microbial counts and beneficial microbial population will also be more in the coconut leaf compost compared to the base material. This enables disposal of coconut wastes in a less expensive way and eco-friendly manner with the benefit of producing high quality organic manure in the coconut plantation itself. Various methods such as cement tanks, trenches as well as composting in the coconut basin itself can be adopted for vermicomposting wherein composting in the basins itself reduces the cost of transportation of leaves and application of vermicompost. The leaf dry matter production by tall coconut palms is

Production of vermicompost

around 32 kg/palm/year and hence the availability of leaf from one hectare of coconut plantation can be estimated as 5.6 t per hectare per year. In this manner all the leaves produced from one coconut palm can be converted into very good organic manure. The favourable weather conditions for effective vermicomposting in Kerala is found to be the monsoon and post monsoon periods(June to August and September to November).This technology can be adopted in plantations with very limited irrigation facilities as only less number of pits or trenches are to be irrigated. The coconut waste used for oyster mushroom production is also found suitable for vermicomposting and it will have higher content of nutrients (1.0 to 1.3 % N and 0.08 to 0.13 % P) and low C: N ratio. The composted spent substrate also contains higher levels of micronutrients such as Fe, Zn, Cu and Mn when compared to that of the untreated substrate. As vermicomposting can be carried out during most part of the year, it is in a position to provide employment opportunities for the farm families and self help groups as well as for income generation.

Apart from coconut leaves, other agro-wastes like pine apple waste, banana pseudo stem and leaves and glyricidia green manure can also be effectively used along with coconut leaves for vermicomposting. Hence, the agro-wastes generated from coconut based cropping system can also be recycled efficiently in the production system.

For large scale composting, permanent cement or brick tanks can be constructed to provide an opportunity to maintain appropriate quantity of food substrate, optimum moisture, temperature and other factors which are very essential for production of efficient and quality vermicompost. This will also give proper protection for the worms from predators like rodents, ants, birds and wild boars.

The water-soluble components from vermicomposting tanks may be collected as leachate by passing water slowly through the composting beds or by simple suspension of vermicompost in water. This vermiwash is honey-brown in colour with a pH of 8.5 and contains both major and minor nutrients in appreciable quantity. Growth promoting hormones like IAA and GA are also present in vermiwash. It is ideal for foliar applications after sufficiently diluting, based on the need. Vegetables and ornamental plants have been reported to respond very well to this treatment.

3.2.3. Vermicomposting of coir pith

Coir pith is yet another organic material available in huge quantities from coir processing units. Extraction of one kilo gram of coir fibre generates two kilo grams of coir pith. Approximately 180 grams of coir pith is obtained from the husk of one coconut. In India an estimated 7.5 million tonnes of coir pith is produced per annum. Coir pith hillocks are common in the neighbourhood of fibre extraction units. This spongy cork like material left as such is normally resistant to biodegradation and is a source of environmental pollution. Though coir pith has a number of beneficial properties like improving soil physical properties and moisture holding capacity to a great extent, its direct utilization as manure is not advisable as it contains large amounts of lignin (75 per cent) and phytotoxic polyphenols and less of nitrogen**.** Hence, it is to be applied to soil only after composting.

Technologies for large scale composting of coir pith has been standardized at Central Plantation Crops Research Institute, Kasaragod with amendments like poultry manure, lime and rock phosphate @ 10 kg, 0.5 kg and 0.5

kg ,respectively for every 100 kg of coir pith as well as inoculation of biopolymer degrading micro organisms at 0.2 % level. The raw coir pith with a C: N ratio of 100-112:1 can be converted to an excellent organic manure with the C: N ratio of 17-24:1 within a short period of 40-45 days. *Pleurotus* spp. have the capacity to degrade part of the cellulose and lignin present in coir pith by production of enzymes viz., cellulases and lactases. The lignin content also reduces considerably.

3.2.4. Coconut wastes as mulch in plantations

Coconut leaves, husk and coir pith could be utilized as mulches to reduce the loss of soil moisture and create conditions for proper root growth and proliferation of soil flora and fauna. Decomposition of the mulches after a period of time results in enrichment of soil organic matter pool. Coconut husk is an important organic material and a good source of plant nutrients. On dry weight basis, the average composition of material is 0.23% N, 0.04 % P_2O_5, 0.78 % K_2O, 0.08 % Ca and 0.05% MgO. On an average husk constitutes 45% of the weight of nut and, on this basis, a nut weighing 1,000 g will have 450 g of husk with 20% moisture. The recycling of it in the farming system has been found to cause significant improvement in the productive capacity of the soil.

Burial of husk in trenches in between the rows of palms is highly effective for moisture conservation in coconut gardens. Husk burial is to be done at the beginning of the monsoon in linear trenches of 1.5 to 2 m wide and about 0.3 to 0.5 m deep between rows of palms with concave side of husk facing upwards. Each layer is to be covered with soil. Husks can also be used as surface mulch around the base of the palms. Husks in a single layer are to be placed with convex side up around the palm up to a radius of 2 m from the base. Coconut husks are also important sources of potash, which becomes available to the palms over a period of time.

3.3. Recycling of by-products from livestock farming (manure)

Integration of crops and livestock can also be widely practiced in coconut gardens to generate not only additional income but also to provide relief against the fluctuating prices of nuts besides generating more employment. Mixed farming involves integrating animal enterprises such as dairy, poultry, duck rearing and aquaculture and cultivation of shade tolerant fodder crops in the interspaces of coconut as well as effectively recycling all the organic residues. The animals not only enhance the nutritional status of the household members but also help to augment the farm income by the

sale of milk, eggs and other products. While the crop residues and fodder provide animal feed, the manure and litter of the livestock provide renewable sources of organic matter and plant nutrients. They help reduce dependence on inorganic chemical fertilizers and maintain soil health, resulting in a high degree of organic recycling. Such integration will also maximize the beneficial impact of species diversity on soil fertility. Here the system is kept productive by maximizing the complementary and synergistic effects of the components involved.

Fodder grasses such as hybrid Napier and Guinea grass can yield about 50 to 60 tonnes of fodder per hectare in a year under coconut shade. This will be sufficient to maintain five crossbred milch cows and provide enough farm yard manure that can be used as a component for meeting the on farm organic manure requirement of the system. This will also increase the labour opportunities in the farm. Biogas plant of suitable capacity can also be installed in the farm for production of biogas for use in the farm house and slurry for manuring coconut and other component crops.

3.4. Application of biofertilizers in organic farming

Micro organisms present in the soil play an important role in nutrient solubilization, mobilization, uptake and recycling. They have very wide potential as they increase nutrient availability, stimulate plant growth, control soil borne pathogens and accelerate decomposition of organic material, which help to increase crop production as well as maintain sound environments for crop production. The health of the soil is chiefly determined by its resident microbial flora. The group of micro-organisms responsible for nitrogen fixation, phosphorus mobilization and production of plant growth promoting substances are used as biofertilizers in coconut based cropping systems. The coconut roots harbour association of nitrogen fixing bacteria such as *Azospilillum lipoferum*, *Azospirillum brasilense*, *Herbaspirillum frisingense*, *Bacillus* sp., *Burkholderia* sp., *Azoarens* sp., *Arthrobacter* sp., and *Beijerinckia indica*. Bacteria such as *Pseudomonas* sp. and *Bacillus* sp. and fungi including *Aspergillus* sp. and *Penicillum* sp. are predominant phosphate solubilizers in the coconut root region. These microscopic microorganism are mass multiplied and formulated using locally available career materials and used as biofertilizers for sustainable organic coconut farming.

Bacillus sp from improving coconut growth

Fluorescent Pseudomonas for coconut growth promotion

Bioferilizer formulations of nitrogen fixing bacteria, *Azospirillum brasilense* and phosphate solubilising bacteria, *Bacillus subtilis* are used as inputs in organic farming trials in coconut as soil application at the rate of 100g per palm annually along with organic amendments. Plant Growth Promoting Rhizobacteria (PGPR) *Pseudomonas fluorescence* and *Bacillus subtitis* formulations have also been found to be important as biopriming agents to enhance the growth and vigor of coconut seedlings.

The beneficial nature of biofertilizers becomes even more important in coconut based mixed cropping/ farming systems as the component crops continually add plant residues to the soil which undergo organic recycling. This leads to alterations in the composition of the rhizosphere, which promotes the growth and population of beneficial microorganisms. Inclusion of livestock enterprises also creates a favourable environment for proliferation of beneficial microflora. In mixed cropping, dominated nitrogen-fixing microbial group is the bacterium *Beijerinckia* and phosphate-solubilizers such as *Pseudomonas* sp., *Bacillus* sp., *Aspergillus* sp. and *Penicillium* sp. are present in higher numbers. Not only this, higher inhibition potential of resident soil bacteria to phytopathogens is seen in coconut based cropping systems when

compared to coconut monocropping systems. When coconut is grown with cacao, rhizosphere activity increases and a better mobilization of phosphates take place coupled with fixation of nitrogen and production of growth substances such as auxins and gibberellins in rhizosphere, which is observed to enhance yield.

Soil amendments as well as farming practices also bring about a protracted change in rhizosphere microflora, which favour the growth of specific microorganisms, thus leading to better plant growth and crop yield. For example, organic amendments like cow dung increase VA-mycorrhizal colonization as well as the population of phosphate solubilizing bacteria in the root zone of coconut palms. Other organic amendments such as farm yard manure, coir pith, neem cake and green manures. can be combined with microbial inoculants like *Beijerinckia indica* for improving the nitrogen fixation by indigenous diazotrophs in coconut soils.

4. Crop diversity in coconut based cropping system

4.1. Mono cropping vs mixed cropping

In many coconut growing countries, coconut as a mono crop is only marginally productive and profitable and hence, a cropping system involving inclusion of compatible crops is necessary. The interplay of various factors like limited size of holding, number of trees, needs of the family, labour requirement for crop, year round returns, easiness of marketing are some of the considerations for the farmer to diversify his farm operations for higher returns by adopting intercropping, mixed cropping or introducing other enterprises like dairy, poultry etc. in the system. Under coconut based cropping system, the same land can be put to use to produce other crops so that the productivity of the land can be increased.

Life cycle of palms	Light/Shade availability	Crops suitable as companions
1st phase-up to 8th year	Good transmission of light, lowers with age of palms	Annuals/Biennials
2nd phase-8th –25th year	Maximum ground coverage and hence poor light availability	Not very deal. However shade tolerant crops can be grown
3rd phase-older than 25 years	Increase in plant height and crown. More light is available	Ideal for perennial mixed crops requiring more light

From the land utilization point of view, a pure stand of coconut utilizes only 22% of the area at a spacing of 7.5 × 7.5 m leaving nearly 78% of the area not effectively utilized. Thus the planting method and growth habit of coconut palms make them highly adaptable for crop diversification in the plantation (Table 1). A well-spaced coconut garden provides adequate inter- and intra-row spaces where it is possible to grow a variety of useful seasonal and perennial crops.

The following crops can be cultivated as inter/mixed crops.

Cereals: Rice, maize

Legumes and pulses: Groundnut, horse gram, cowpea, sun flower

Tubers: Tapioca, sweet potato, yams, colocasia, amorphophallus

Spices and condiments: Ginger, turmeric, chilly, vanilla, pepper, nutmeg, cinnamon, clove

Fruit plants: Banana, pineapple, papaya

Floriculture plants: Orchids, anthuriums, heliconia, jasmine, marigold

Medicinal and aromatic plants: vetiver, kacholam, arrowroot, chittadalodakam, thippali, aloe vera, chittaratha, neelayamari, sathavari,oorilia, moovila,patchouli etc.

Beverage crop: Cocoa

4.2. Cropping /farming system approach for sustaining soil productivity

Nutrient management in cropping/farming system is difficult as it is influenced by various factors like crop requirements, differential response of crops, crop residue additions, management practices suiting to crop needs, water requirement of crops as well as soil environment. It is therefore imperative that the whole system should be considered as one unit and cultivation practices followed for the system as a whole.

Farming/ cropping systems designed based on local resources and needs consider the whole farm as a single unit and all components are given importance in the functioning of the system. These systems create conditions and microclimate suitable for the multiplication and activity of a variety of beneficial organisms. They protect soils from direct

sunlight and rainfall and thus preserve soil organic matter reserves. As a number of component crops are involved, soil resources are utilized to the maximum extent, thus preventing the loss of nutrients from the system. As the biomass production per unit area will be very high, when the available organic wastes are recycled, soil health and coconut yields can be sustained even in the absence of external inputs. These systems can be adopted even by small scale farmers and coconut based homestead farming in Kerala is a typical example.

Coconut based farming system (CBFS) can be adopted by many small scale farmers as a self sustaining and risk minimizing strategy. The rationale is that the productivity of the coconut land can be increased. In large scale farm operations, CBFS is also adopted because it provides an efficient resource allocation strategy and minimizes input costs. The adoption of CBFS encourages improved husbandry practices, increases the productivity of coconut land, and enhances the viability of coconut ventures.

A multi-storey cropping system is a more complex CBFS, developed to accommodate two or more intercrops of different heights, canopy patterns and rooting systems, to maximize the use of available sunlight, nutrients, moisture and land area under coconut. The fundamental objective is to increase the productivity of coconut land. The coconut palm serves as the 'top floor', whereas, perennials such as cocoa, bananas, papaya etc., form the mid-storey crops, and short-growing crops such as spices, vegetables, pineapple, fodder etc., form the ground floor. As coconut palms do not have deep root system, the nutrients that are leached down are lost to the palms. When plants possessing deeper roots and greater root volume are included in the coconut based cropping system, the nutrients available below the root zone of the palms are captured and deposited on the soil surface via shed leaves, fallen twigs and other plant parts. These materials on decomposition release nutrients for the uptake by the palms.

The micro climate inside the multi-storeyed cropping system is characterised by lower maximum temperature, smaller diurnal variation and less evaporative demand compared to mono cropping system. Cultivation of different crops in a particular field results in the continuous addition of bio mass and higher level of nutrient supply which have a positive impact on the physico-chemical and biological properties of soil. The beneficial effects of such a system are evidenced by the enhancement of microbial population, improvement of soil fertility status and better utilization of natural resources for the benefit of plant growth and sustainable crop yields.

5. Plant health management

The basis of pest and disease management in organic farming systems is the reliance on the inherent equilibrium in nature. Use of bio control agents plays a crucial role in this aspect. The natural enemies are insect predators (insects that consume part or all of pest insects), parasites (insects that use other insects to produce their offspring, thereby killing the pest insect in the process), and pathogens (diseases that kill or decrease the growth rate of insect pests). Predatory insects on organic farms include lady beetles, lacewings and spiders. Parasitic insects include wasps and flies that lay their eggs in/on pest insects, such as larvae or caterpillars. The emphasis on organic plantations should ideally be on the use of varieties resistant to pest and diseases. Neem-based pesticides produced from neem kernel extracts also can be used to repel pests. Spraying of diluted cow urine can be frequently practiced. The extracts derived from the aerial parts (leaves and stem) of *Artimisia vulgaris, Urtica dioica, Polygonum runcinetum and Eupatorium glandulosum* which are profusely growing in the plantations can be used for their antifeedant action against some leaf eating pests. Careful management in both time and space of planting of inter crops not only prevents pests, but also increases population of natural predators that have natural capability to control insects, diseases and weeds. Other methods that can be generally employed for the management of pests and diseases are: clean cultivation, improving soil health to resist soil pathogens and promote plant growth; crop rotation; encouraging natural biological agents for control of diseases, insects and weeds; using physical barriers for protection from insects, birds and animals; modifying habitat to encourage pollinators and natural enemies of pests; and using semi-

chemicals such as pheromone attractants and trap pests. Biopesticides including micro organisms, parasites, predators and natural plant based pesticides from neem, tobacco and garlic are effective in managing pests of coconut and other intercrops. There are several examples of use of effective bio control agents for suppression of pest and diseases of coconut and other component crops.

The important pests and diseases as well as their management practices that are to be followed under organic system of cultivation are given in Table 2. It will be most ideal if a community approach is adopted in the management of various pests and diseases of coconut.

Many plants are suitable as botanical pesticides and can be incorporated in the cropping system.

6. Crop response to organic and bioinputs

A field experiment was initiated at the Central Plantation Crops Research Institute, Kasaragod during 2002-03 to evaluate the performance of coconut palms under different organic cultivation practices as well as to understand the effect of such treatments on soil chemical and biological properties. The experiment was conducted on West Coast Tall, the popular coconut variety and Chandra Sankara, a hybrid (COD x WCT). The age of palms was 35 years. Vermicomposting in the basin, application of bio fertilizers (phosphobacteria and azospirillum @100 g /palm/year) and cover

Table.2. Management of pests and diseases under organic cultivation of coconut

a. Pests

Name of pest	Management practices
Rhinoceros beetle	1. Field sanitation 2. Hook out beetles from attacked palms 3. Fill three leaf axils around spindle with three Naphthalene balls covered with fine sand 4. Treat manure pits and other possible breeding sites with leaves and tender stems of *Clerodendron infortunatum* or *Metarzhizium anisopliae* (the green muscardine fungus) 5. Release *Baculovirus oryctes* infected adults @ 10-15 / ha
Red palm weevil	1. Field sanitation 2. Leaf axil filling as in case of Rhinoceros beetle 3. Set coconut log traps with fermenting toddy or pineapple or sugarcane activated with yeast or molasses to attract weevil 4. Use of pheromone trap for attracting and killing adult weevils (this should be adopted as a coconut community level)
Leaf eating caterpillar	1. Cut and burn first affected leaves 2. Periodically release larval / pupal parasitoids such as *Goniozus nephantidis, Elasmus nephantidis* and *Brachymeria nosatoi.*
Coried bug	1. Apply neem based bio pesticide on the newly opened inflorescence
Coconut eriophyid mite	1. Collect and destroy all the fallen buttons of the affected palm 2. Apply 2% neem oil + garlic emulsion or commercial neem formulation azadirachtin 0.004% (Neemazal T/S 1% @ 4 ml per litre of water) in the crown on young bunches.

b. Diseases

Name of disease	Management practices
Bud rot	1. Phytosanitation by removing severely affected palms. 2. Apply 10% Bordeaux paste on the cleaned crown. Spray 1% Bordeaux mixture on spindle leaves and crown of diseased palms 3. Provide adequate drainage in gardens and avoid overcrowding.
Root(wilt) disease	1. Follow strictly all prescribed prophylactic measures for other pests and diseases 2. Grow green manure crops in basins and incorporate and supply adequate organic manures
Leaf rot	1. Remove the rotten portions from the spear and the two adjacent leaves. 2. Spray crowns and leaves with 1% Bordeaux mixture
Stem bleeding	1. Remove water stagnation and apply recommended doses of organic manure to make the palms healthy. 2. Apply neem cake @ 5 kg per palm in the basin along with other organics. 3 Use *Trichoderma hamatum* and *Trichoderma harzianum* for the management of the disease

cropping of *Pueraria* in the interspace recorded higher nut yield of 137 nuts/palm/year and 106 nuts/palm/year) for D x T and WCT, respectively.

7. Gaps in current knowledge

Farmers who are applying heavy dose of chemical fertilizers will probably experience some loss in yields when converting their farms into organic production. There is a period of time between stopping the use of chemical inputs and sufficient biological activity being restored to the land (e.g. growth in beneficial insect populations, nitrogen fixation from legumes) during which pest suppression and fertility problems are typical. The degree of yield loss varies, however, and depends on factors such as the inherent biological attributes of the farm, farmer expertise, and the extent to which chemical inputs were used earlier. Where soil fertility is low and biological processes have been seriously disrupted, it may take years to restore the ecosystem to the point where organic production is possible. One approach to tide over the difficult transition period involves converting the farm to organic production over a period of time so that a smooth transition takes place and the entire operation is not at risk. Sufficient data on these aspects are lacking at present.

Profitability of organic cultivation is influenced considerably by the ability to secure price premiums. The lack of adequate marketing channels can prevent an organic producer from securing the premium for some or all of his produce. Famers are also unsure whether the premium will remain at least at the current level. Plantation crop farmers are also afraid that increasing the supply level might lead to a collapse in price premiums. But these apprehensions could be cleared by creating consumer awareness of the merits of organic products and production methods. Though producers are aware of the ill effects of chemical farming, they are to be educated on the potentialities of organic farming for large scale adoption.

7. Future thrust and development opportunities

As there is increasing demand and premium price for organically produced agro products including that from coconut, there is considerable potential for exploitation of organic farming technology in coconut based cropping system. The results from research studies and from farmers' own experiences point towards the ample opportunities available for organic cultivation by recycling residues available in coconut plantations not only from coconut and intercrops but also from the nitrogen fixing legumes that could be grown in the coconut basins and interspaces. The utilization of effective bio inoculants of beneficial microbes for improving the availability of nutrients and biological control of soil borne pathogens will promote biological interactions for the development of a sound ecosystem. On farm production of organic manure at the plant growing site itself will reduce transportation cost and enhance the economic viability of the production technology. Participatory technology development may be needed for spreading the benefits of organic cultivation among farmers. The recent introduction of cluster approach in the coconut based cropping system programme can be taken as a step towards the adoption of organic cultivation of coconut and other crops in a more meaningful way in the years to come.

Organic farming can be a reality in coconut cultivation provided all the steps are taken to create awareness and arrangements made for certification using the guidelines of organic production. Further strengthening of organic farming research system is also necessary to address various aspects of organic farming for improvement of technologies from time to time. To achieve the potential of organic farming in coconut, farmer participatory training is essential. The farmers also will require financial support to meet the initial yield reduction and other cost of cultivation. They also should be provided adequate market intelligence and marketing support for getting the maximum profit out of organic farming. As the diffusion of any technology will depend on the satisfaction of farmers with regard to the economics of cultivation, they should be assured encouraging price support for their organic produce and products. Elaborate market promotion for organic coconut products may be needed to catch up in the markets.

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Coconut, an inevitable crop for North Eastern states

Rajeev P George, L. Obed

Coconut cultivation and the expansion of area under coconut has gained momentum with the formation of the Board in non traditional areas like North and North Eastern states. The nursery raising programme and supply of seedlings in these areas initially started with the procurement and supply of seed nuts from South India by the Seed Procurement Unit of the Board. The North Eastern region comprising of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura extends over 2.58 lakhs sq. km. and accounts for about 25% of the country's population. The region is endowed with natural resources like, fertile soil, abundant water availability, geographical diversity and suitability for varied cropping systems to take up farming successfully, especially in horticulture and plantation sector.

Coconut is grown in an area of 32661 ha in the North-Eastern region covering the states of Assam, Tripura, Nagaland, Arunachal Pradesh, Meghalaya, Manipur and Mizoram. This constitutes 17 percent of the total area in the country. The expansion of the crop gained momentum after the formation of Coconut Development Board. The Board has set up its Regional Office and State Centres to cater to the requirements of this region. Utilization of coconut for religious and social purposes was prevailing in these regions even when coconut utilization was not so prevalent.

Consumption of coconut and coconut products in the various preparations and other social and religious functions are on the increase now. Therefore there is increasing demand for coconut and this increasing demand exposes the vast potential of expanding the crop in the North and North-Eastern region.

Assam

Assam is traditionally rich in horticultural produce due to its diverse and unique agro-climatic conditions. Horticultural crops occupy 15% of the gross cultivated area. Coconut and arecanut are the high value commercial crops grown here. Coconut is grown in an area of 19,426 ha. Coconut production in the state has shown an increasing trend in the last two decades. In 1999-2000 the production of coconut was 150.1 million nuts from an area of 20,238 ha., which further increased to about 161 per cent in production and 152 per cent in area as compared to 1985-1986. In 2008-09, there was a marginal increase in area i.e. 21.3 thousand ha., with total production of 154.3 million nuts. However in 2010-11 area under coconut decreased to 19,426 ha with a total production of 1,585.65 lakh nuts and the productivity to 8163 nuts/ha. (Source: Directorate of Economics and Statistics, Guwahati) Coconut is grown in all the twenty seven districts. Among these districts, Nagaon leads in area with 3,343 hectares and a production of 324.11 lakh nuts

Boundary plantation of coconut around pond at Panipara, Hajo, Assam

Mother palm at Panipara, Hajo, Assam

which alone comes to 20 per cent of the total coconut production of the state. Barpeta and Kamrup districts are next to Nagaon. Coconut plants are mainly grown as rain fed crop without much care or crop management. Average selling price of matured coconut is Rs 30-35 per nut and tender coconut is Rs. 20-25 per nut.

The cultivar grown in Assam is 'Assam Green Tall' named as Kamrupa. The other varieties released under the agro climatic condition of the state for cultivation are Bengal Hazari, Bengal selected WCT and TxD hybrid 'Chandrasankara'.

Coconut cultivation is still a homestead practice in the state in the northern banks of the river Brahmaputra and selected areas in the southern bank in a sporadic manner. The productivity of coconut in Assam is low. Coconut Development Board helps the farmers in scientific cultivation for increasing the area and productivity of coconut in the state. Board in association with the Directorate of Horticulture, Central Plantation Crop Research Institute, Kahikuchi, Horticultural Research Station, Kahikuchi and different identified NGOs from different districts of Assam facilitates in the distribution of quality planting material in the state. During the current season Board is having around one lakh coconut seedlings at its Demonstration Cum Seed Production Farm at Abhyapuri. In the coming years it is targeted to produce around two lakh fifty thousand seedlings for extending the area in North &Eastern region.

Coconut Research:

The research on coconut in Assam was first initiated by the Department of Agriculture at Rajabari near Bokakhat now in Golaghat district in the year 1957 with a research project sponsored by the state government. Later the project was shifted to the Regional Fruit Research Station, under the Department of Agriculture at Kahikuchi. The systematic research of coconut started in the year 1973 with the transfer of entire coconut research network to the Assam Agricultural University. Horticultural Research Station at Kahikuchi under Assam Agricultural University is doing coconut research and has been maintaining a large number of germplasms including exotic as well as local types. The All India Co-ordinated Research Project on Palms was started at Horticultural Research Station, Kahikuchi under AAU in 1985. 'KAMRUPA' originally known as 'Assam Green Tall' is considered as one of the most promising cultivar released by University for this region, a selection from the local germ plasm based on preliminary as well as multilocational yield trials in the farmer's field. At present Horticultural Research Station, Kahikuchi is maintaining more than 1000 palms in the station.

Central Plantation Crops Research Institute, Research Centre, Kahikuchi was established in 1959 as Regional Arecanut Research Station under Central Arecanut Research Station (CARS). Later, the centre was combined with the Central Plantation Crops Research Institute in 1970 with objectives of producing quality planting materials of major plantation crops, screen and develop coconut varieties for the region and standarize agro-techniques for major plantation crops. Around 500 coconut palms are maintained in CPCRI, Kahikuchi.

Tripura

Agriculture is the back bone of Tripura's economy. The warm and humid climatic condition is

congenial for producing fruits, spices and vegetables. Main horticultural crops are mango, pineapple, orange, litchi, jackfruit, cashew nut, lime, lemon, areca nut and coconut. Rubber and tea plantations are also popular in Tripura. Main agricultural crops grown here are rice, wheat, sugarcane, cotton, jute, mesta, pulses, oilseed, potato and maize.

Tripura is a hilly state in the North Eastern region of India having suitable soil, hot and humid climate suitable for coconut palm. Coconut cultivation was initiated in the state as homestead garden as boundary planting. The coconut plantation in Tripura is comparatively free from diseases. In, 2008-2009, area under coconut was 58,000 ha with production of 11.40 million nuts with productivity of 1966 nuts per ha. Average selling price of matured coconut is Rs 20-30 per nut and tender coconut is Rs 25-30 per nut.

Since 1985-86 Board in association with the Horticulture Department, Government of Tripura is implementing various schemes for the development of the crop. Coconut is mainly grown in Tripura South, Tripura North, Tripura West, Dhalai and Tripura East.

Manipur

Coconut is growing in some pockets of the state over an area of about 2000 ha under rainfed condition. The people of Manipur consider coconut as an important item in social, religious, cultural and economic use. Huge quantities of coconut are imported from outside the state particularly Assam and Myanmar. Coconut is readily available in Imphal and the rate varies from Rs. 30 to Rs. 50 per nut. Major coconut growing areas are Jiribam, Imphal East, Chandel, Tamenglong and Ukhrul district bordering upto Myanmar. The estimated production and productivity of the state is 16.47 m. nuts and 5067 per ha/ year.

Meghalaya

Meghalaya is basically an agricultural state with about 80% of its population depending entirely on agriculture for their livelihood. Nearly 10% of the geographical area of Meghalaya is under cultivation and it comprises of the low lying hilly areas. A substantial portion of the cultivated area is under the traditional shifting cultivation known locally as Jhum cultivation.

Climatic conditions in Meghalaya permit a large variety of horticulture crops, vegetables, flowers, spices and medicinal plants. Food grains (60% of the total crop area) are the most important crop grown in Meghalaya. Other crops grown are potato, ginger, citrus, pineapple, cashew nut, areca nut and black pepper.

The main coconut growing areas are Garo hills, because of its less lower altitude hills concentrating in the East Garo Hills, West Garo Hills and some areas of South Garo Hills. The total area under coconut in Meghalaya is estimated as 1050 ha with a production 5.21 million nuts and productivity 3,065 nuts per ha. Average selling price of matured coconut is Rs 15/nut and tender coconut is Rs 10/nut.

Nagaland

The state of Nagaland is basically a horticultural land due to its agro climatic condition, topography and type of soil which is best suited for cultivation of all types of horticultural crops. Main horticultural crops grown here are passion fruit, orange, pineapple, banana, citrus, mandarin, peach, nut fruits, coconut, vegetables, spices, root, tuber crops, mushroom, medicinal plants, aromatic plants,

Coconut plantation at Zikzak Farm, West Garo Hills, Meghalaya

flower etc. and main agricultural crops are rice, maize, tobacco, oilseeds, pulses, fibers, potato and sugarcane.

The tropical climate in the foot hills and temperate climate in the hilly region with abundant rainfall spread over seven months offers scope for coconut cultivation. In the state, coconut is grown in lower altitude areas i.e. Dimapur, Mokokchung, Mon, Peren and Wokha. The area under the crop is 900 ha and the average selling price of matured coconut is Rs. 25 and tender coconut is Rs. 20/nut.

Coconut Development Board in association with the Horticulture Department; Government of Nagaland and an NGO, All Nagaland Coconut Grower Association, is assisting the farmers in the management of coconut gardens.

Arunachal Pradesh

The humid and hyperthermic climate in foothills of Arunachal Pradesh is suitable for growing coconut. The main coconut growing districts are Changlang, Teju, Papump and Passighat. Besides, these districts, coconut is also grown in certain areas like Mahadevpur, Namsai, Bordumsa Deomali, Roing and Sonpura. The total area under coconut is 800 ha. Average selling price of matured coconut is Rs. 40-45 and tender coconut is Rs. 25-30 per nut.

Under Boards scheme, Arunachal Pradesh has produced about 1,13,500 coconut seedlings from its Regional Coconut Nursery. Coconut seed garden is established in Arunachal Pradesh at Papumpare. In spite of the mountainous landscape, Arunachal Pradesh is increasing its area under coconut in areas adjoining Assam.

Mizoram

The geo-climatic situation of Mizoram offers excellent scope for growing different horticulture crops including mandarin orange, banana, passion fruit, grape, pineapple, vegetables, spices, plantation crops and medicinal and aromatic plants of high economic value. Major agricultural crops are rice, maize, pulse, black gram, mustard, potato, cotton, sugarcane and sesame.

Mizoram has the lowest plantation of coconut i.e. 280 ha producing 0.64 million nuts with productivity of 2,857 nuts per hectare. Average selling price of matured coconut is Rs. 50-60 and tender coconut is Rs. 40-45/nut

Major coconut growing areas of Mizoram are Aizwal, Lunglai and Kolasib districts adjoining Assam and Tripura are the coconut growing areas.

Board in association with Directorate of Horticulture and an NGO, All Mizoram Farmer's Union, Gen. Hqrs. Aizwal, Treasury Square, Aizwal, Mizoram, Pin-796001 (Contact no-91- 389-2318189/ 2318232 & Email-amfugenhqrs@rediffmail.com) is giving technical assistance and helping farmers for the supply of quality planting materials.

Effect of shifting cultivation in north eastern.

Shifting cultivation in the North Eastern states also known as 'Jhum' cultivation or rotational agro-forestry is being practiced by the traditional tribal societies. Forests are being depleted for timber or soil and stones. The jhum cultivation leads to decline of productivity by 50% and the farmers are experiencing food shortage of 2 to 6 months every year.

However, efforts to wean farmers away from shifting cultivation have not been very successful. A change in policy is required keeping in mind the changing requirements. A meaningful solution to the problem of jhum has become critical, not only from the point of biodiversity, but also for productive agriculture including proving food crops in the region. The solution to the problem of the shortening of fallow cycle lies in strengthening this already weakened agro-forestry system, through fallow management using appropriate tree species. Subscribing the philosophy 'don't fix it if it isn't broken' happened here also, nothing much has been done till now. As a result vast areas have been depleted already. Now useful trees are being planted by the farmers to sustain the farm land and to ensure food security and income. Farmers in all the seven North Eastern states have taken up coconut as a companion crop along with other horticultural crops and coconut is gaining importance. Coconut Development Board in association with Department of the respective State Horticulture Departments and NGOs are facilitating the supply of quality planting materials in this region and helping the farmers in regaining the lost glory.

Director & Deputy Director, CDB, Guwahati

No Farmer - No Future

Sasikumar C

Vasanth Velusamy, an MBA graduate from Udumalpet of Tamil Nadu firmly believes that if there is no farmer, there won't be future. Vasanth had to opt this field forcefully as his father Mr.Velusamy, who was also a coconut farmer, suddenly expired when he was doing his plus 2. He kept aside his ambition of becoming an engineer and took up farming as a profession. Now he dreams of becoming the owner of world's largest farm business company based on coconut and has set it as his goal. When the new generation is behind the white collar jobs, Vasanth is inspiring all to take up agriculture as a profession. His wife Ms. Kavitha Vasanth, a farmer's daughter also loves and supports his profession and encourages him to make his dream come true. She is doing her Bachelor of Farming Technology (BFT) at TNAU along with the herculean task of running home and the farm.

Vasanth's 37 acre Karisal Farm in Sinjuvady located on Anthiyur Kundalapatti Road, Pollachi Taluk has 2600 yielding coconut palms. This includes 700 MYD, 700 COD, 1000 DxT and 200 tall viz. tiptur, arasapatti, WCT varieties. The triangular model planting was done during 2004. A spacing of 25 ft is maintained between tree and 40 ft between the east west directions. Karisal Farm has productivity of 200 nuts per palm for DxT variety, 180 for dwarf and for the tall variety 110 nuts.

Karisal Farm is into hybridization since 2011. He has set apart 500 mother palms in 7 acres exclusively for hybridization. Karisal Farm's hybridized nuts are very popular among Pollachi farmers. The farm has its own trained man power for hybridization activities. DxT hybrids, MYD, COD and other tender coconut varieties are produced here.

Coconut Development Board is procuring nuts from his farm for its CPS on a lesser price of Rs.18 per nut. He is happy to supply his seednuts to the Board since he has procured the seedlings from the Demonstration cum Seed Production Farm of the Board at Mandya. He is selling the seed nut of COD @ Rs. 25 and MYD @ Rs. 20. As there is high demand for tender coconut, he is getting Rs.15 –Rs.19 per nut according to the variety at the farm gate.

Vasanth is maintaining a coconut nursery in 4 acres. Presently 8,000 DxT and 7000 dwarf seedlings are available which will be ready for sale by January 2013. He is selling the seedlings @ Rs. 250 for DxT, Rs. 100 for COD and Rs. 75 for MYD at farm gate. Vasanth is keenly concentrating on hybridization since it is helping him to realise higher revenue from coconut farming.

Vasanth Velusamy in Karisal Farm

Emasculation

Since there is sufficient availability of water, irrigation is done through drip system. He has designed a solar copra dryer with a capacity to process 20,000 nuts per day which is under construction. Karisal Farm is following mixed farming. More than 300 tree species like sandal wood, teak, rose wood, mahagony etc. and all tropical and sub tropical fruit crops are cultivated in the farm.

The farm is having to its credit a 1000 sq. mt. poly house which is used as a nursery for coconut, various fruits, vegetables and flower crops. Karisal Farm is into rabbit rearing also. He is maintaining one of the largest private rabbit farms in Tamil Nadu. The manure of rabbit adds to the yield of the farms and reduces the cost of cultivation. He is selling live rabbits @ Rs. 200 per kg. He also supplies rabbits to pharmaceutical companies and star hotels on a higher price. The lucerne grass which is having high nutritional quality (alfa alfa) is used as rabbit feed.

The present annual income of Karisal Farm is nearly Rs. 30 lakhs. He is expecting an additional income of Rs. 25 lakhs by January 2013 through the sale of coconut seedlings alone.

The well maintained palm

Vasanth is planning to establish a seed breeding farm at Elumalai, Madurai in 200 acres. Bringing out new hybrids or select suitable eco types for specific purpose like coir, oil, tender and process industries, developing a multilayer model farm around coconut and building integrated coconut processing unit and starting a farm school specializing in coconut farming are his future plans.

Vasanth is aware that there exists a huge demand for pest and disease tolerant hybrid seedlings. Since there are very few seed breeders and the role played by government agencies is also meager, this sector does have good future potential. He knows that the country is in demand of more than 1 crore seed nut per annum which is a Rs. 100 crore worth business. As there are only few players in the field he is hopeful and determined that he has a bright future. Alongwith Dr. A P J Abdul Kalam, Vasanth too believes that right decision is the secret of success and experience paves the way for taking right decisions.

Rabbit rearing

Let us hope that the success story of Karisal Farm and Vasanth Velusamy may inspire many youth to take up coconut farming business as a challenging career to make better prospects in their life as well as in the economy of the country.

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Technical Officer, CDB, Kochi-11

A youth with a motto to work independently

Mridula. K.

"I want to be my own boss and want to work independently without any dictatorship. That's why I have chosen agriculture as my profession and now am enjoying my work" says Shri Joshi M. Joseph, 34 of Kattipara, Kozhikode district. It is more than 60 years since his family has migrated from Pala, Kottayam to Kattipara.

Joshi in his coconut garden

Coconut intercropped with nutmeg and banana

In his 8 acre garden, he has mainly planted coconut palms. Initially he planted 160 palms and now there are 272 palms. All are naturally crossed TxD variety. 2000 arecanut and 2000 black pepper vines are also grown in the farm. The productivity of the farm is 160 nuts per palm per year and the total production is around 45,000 nuts per year.

Joshi is strictly following various management practices. Both organic and inorganic fertilizers are applied for coconut as well as for the intercrops. The main organic fertilizer applied is cow dung. He is having a biogas plant. The slurry is pumped to the field through channels. Once in a year chemical fertilizer is mixed with the slurry and pumped to the crop. The uniform application of slurry to the palms help in increasing the production as it is properly mixes with the soil and reaches to the system. Some palms infected with stem bleeding disease were cut and removed and is replanted.

Irrigation is done through sprinklers. Mulching is done with dry and green leaves and with coconut husks. He has also done different soil conservation measures like bund for easy irrigation purpose and for conserving the soil moisture. Joshi is also doing the management practices by himself without availing anybody's help. Harvesting is done six times in a year. Harvested nuts are sold in local markets and is supplied to the Kattipara oil mills run by his brother. Since tender coconut is fetching a higher price, Joshi is planning to sell his nuts as tender nuts.

Besides coconut, crops like arecanut, black pepper, tapioca, nutmeg (100 no), cocoa (300 no), banana (Poovan) and vegetables are grown as intercrops. Harvested cocoa is given to Cadbury under buyback system. From other crops Joshi is getting an income of more than Rs.1.00 lakh. He also grows fodder grass for his milch animals. The milk after his personal use is supplied to MILMA. Joshi is having a poultry farm which is looked after by his wife Shinsy. Eggs are sold @ Rs. 5/. He is cultivating vegetables to cater to the need of the family.

Shri Joshi is keeping a very cordial relation with all government

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Solar dryers for copra - academic project helps coconut farmers get better returns

Here is proof that academic research has moved from lab to land and started showing results in the development of the community. The project "Popularisation of Solar Tunnel Dryers for Copra Production in Pollachi Region." of the Science for Equity Empowerment and Development Division (SEED) of the Department of Science and Technology (DST) implemented by a team in Dr. Mahalingam College of Engineering and Technology in Pollachi, has ensured that the coconut farmer is able to produce high quality copra. Six solar tunnel dryers have been constructed at Sulakkal, Devanampalayam, Mandrampalayam, Kanjampatti, Kondegoundenpalayam, and at Vanavarayar Institute of Agriculture in Manakkadavu in Phase I of the project.

Solar tunnel dryer

The project was introduced with the objective to popularise the concept of solar tunnel dryer with biomass backup heater among the coconut farmers, coconut traders and self help group women, for producing high quality copra. The coconut farmers of this region were drying the nuts in the open. This was dependent on weather conditions and hence was hampered by rain and wind. Also, coconuts took six to eight days to dry in the open sun. Wastage was high due to environment and birds. With the solar tunnel dryers drying is possible in two to three days. Superior copra is produced as the drying takes place in closed hygienic conditions, and hence premium quality oil is also ensured.

The dryer is provided with biomass backup furnace to ensure that drying takes place even during non-sunshine period – evenings, nights and rainy season. One unit of the solar tunnel dryer was set up in 2007-08 at Negamam. This was a great hit among farmers, and so the project for another 12 was sanctioned by DST for 2011-13.

The first phase of six dryers was launched recently. The second phase that will involve another six will begin shortly. The college will operate the dryers for five years, at no cost, under a memorandum of understanding with the respective Panchayats, after which they will be handed over to them. The project, with V.V. Sreenarayanan as the Principal Investigator, and S. Ayyappan as the Co-Principal Investigator, has ensured that coconut farmers get more returns with less investment and wastage. What makes the dryer even more attractive is the fact that it can be used to dry anything - from chillies, spices, grapes, groundnuts, and cocoa, to even clothes.

Solar Tunnel Drier With Thermal Storage

A natural convection solar tunnel drier integrated with sensible heat storage material was developed by Department of Mechanical Engineering, Dr.Mahalingam College of Engineering and Technology, Pollachi – 642 003, Tamil Nadu, India to test its performance for copra drying. The experiments were carried out with and without the integration of heat storage materials. Sand was used as the heat storage material in the solar tunnel drier. The drier reduces the moisture content of copra from 52% (w.b.) to 7.2% (w.b.) in 52 h and 78 h respectively with and without the heat storage material. It produces 85% Milling Copra Grade1 (MCG1). In open sun drying, moisture content reduced from 52.3% (w.b.) to about 7.8% in 172 h with an average of 53% MCG1. The average solar tunnel drier thermal efficiency was estimated to be about 18% in both the drying modes.

A community model solar greenhouse drier of size 4 m (W) × 10 m (L) × 3 m (H) at centre was designed and constructed at Negamam village. The semicircular portion of the drier was covered with UV (200 micron) stabilized polyethylene film. No post is used inside the greenhouse, allowing a better use of inside space. Three exhaust vents with adjustable butterfly valves operated manually have been provided at the top of the roof for removing the humid air

Solar tunnel drier

Drying of copra inside the drier

from the drier. Inside the drier the cement flooring was coated with black paint to improve its performance. The drier is provided with metallic racks for keeping the coconuts in layers for drying. The capacity of the drier was to dry 5000 coconuts per batch.

From the experimental work conducted for the drying of copra in the natural convection solar tunnel drier, it was found that the copra can be dried from an initial moisture content of 52.3% (w.b.) to the required moisture 5 level of 7% (w.b.) in 52 and 78 hours respectively with and without using the heat storage material (sand). The open sun drying takes 172 hours for reducing the moisture content of copra to the same level. The use of heat storage material provided continuous drying and reduced the drying time considerably compared to open sun drying. The copra obtained from the solar tunnel drier is of high quality.

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agencies particularly with Krishi bhavan and Coconut Development Board. He has applied for subsidy from Krishi Bhavan under ATMA for mulching with coconut husk in nutmeg. He was the convenor of the cluster programme implemented by the Board during 2006-08. He is of the opinion that the programme helped the farmers to make the practice of cultivating various intercrops along with coconut, which makes farming more profitable.

Shri. Joshi Joseph's advice to other coconut farmers is that multiple cropping/mixed cropping may be adopted for making coconut cultivation profitable. Good quality seedlings especially dwarf and hybrid varieties may be planted to get a good crop and yield. Maximum tender nuts may be harvested for making better income. More dwarf varieties may be planted for the same. After cutting and removing the old senile and disease affected palms, new seedlings must be planted with proper spacing. Try to raise ones own nursery by selecting quality seed nuts from selected mother palms so that we don't need to depend on others for quality seedlings.

In the opinion of Joshi, Board's programme of Friends of Coconut Tree provides employment to many unemployed youths and make them self-dependent. Besides, they have learned the scientific cultivation practices of coconut. Joshi is the president of the Chembrakunda Coconut Producers Society registered with Coconut Development Board.

Joshi's role model is his father, Joseph who is also an active farmer. Joshy is supported by his mother Mary and his wife Shinsy. He is planning to purchase a mini Hitachi for making coconut planting easy. His advice to youngsters is to opt agriculture as profession as it makes one self-dependent and independent. For further details Contact: Joshi M.Joseph, Manimala (H), Kattipara (PO), Thamarassery (Via), Kozhikode 673573, Ph: 9446953185/ 0495-2270237.

Technical Officer, CDB, Kochi-11

Stakeholders' Meet on Coconut Plantation held

A view of the meeting. Seen are :Dr. N. Kumar, Dean (Horticulture), TNAU, Coimbatore, Shri. T.K. Jose, IAS, Chairman, Coconut Development Board, Shri. M. Kannappan, Former Union Minister, Coimbatore, Shri. T.R. Baalu, MP, Sriperumbathur, Shri. Sharad Pawar, Union Minister of Agriculture, Shri. S.R. Balasubramanian, Former Union Minister, Coimbatore, Dr. George V. Thomas, Director, CPCRI, Shri. T.A. Krishnaswamy Gounder, Farmers' representative, Pollachi and Shri. R. Kalaiselavan, Member, Coconut Development Board

A Stake holder's Meet on Coconut Plantation under the auspices of Coconut Development Board, Regional Office, Chennai was held at Indian Institute of Technology Chennai on 26th October 2012. Shri.Sharad Pawar, Minister for Agriculture, Government of India inaugurated the meet and T.R.Baalu, MP, Sriperumpudur Tamil Nadu presided over.

Shri. Sharad Pawar, in his inaugural address appreciated the progress made by the state of Tamil Nadu in area, production and productivity of coconut. He informed that Coconut Development Board (CDB) is implementing various schemes to help and support coconut farmers. Government is aware of the steep price fall of coconut. It is imperative to encourage collectives of farmers like Coconut Producer's Societies (CPSs) to take up primary processing at the farm level. A well thought out plan is necessary to strengthen farm level processing so as to enable farmers to realize higher income through value addition and also receive the benefits of higher MSP announced by the Government of India. Tender coconut water has now been accepted as a healthy and nutritious drink across the country. In order to arrest the price fall, the Ministry of Agriculture is demanding for export of coconut oil without quantity restriction, port restriction and packaging restriction. Since Tamil Nadu is the second largest producer of coconut in the country, has enormous potential for processing of coconut for value addition. Districts with area more than 25,000 ha under coconut cultivation may be selected for establishing Coconut Parks. He requested the State Government to provide 25% subsidy for establishing coconut processing units for producing value added products.

The participants

Shri. T.K. Jose, IAS, Chairman, Coconut Development Board in his welcome address extended his gratitude to the Minister, Member of Parliament and Member of Legislative Assembly for their initiative in the conduct of stakeholders meet to address the problems of coconut farmers.

In the interactive session which followed, farmers shared their problems in copra procurement, price fall, marketing and also on the possibility of establishing a DSP Farm in Tamil Nadu. Chairman informed the Minister that field unit

offices can be opened in each district, which is having more than 10,000 ha under coconut. Seminars and awareness programmes can also be conducted on need basis. 1000 coconut outlets or tender coconut parlours may be also started in the state in the major tourist spots, hospitals and on wayside of National highways.

Shri. Sharad Pawar in his concluding remarks informed that copra procurement will be enhanced further. More collection centers will be opened. Both the central and state government will extend maximum support to Coconut Producers' Societies and the Producer Companies. Since Tamil Nadu is having high potential, coconut processing units and tender coconut packaging /parlours may be established in the state by availing 25% subsidy under Technology Mission on Coconut. Ministry of Food Processing Industries will be addressed to provide another 25% subsidy. State Governments will be addressed for distributing coconut oil through PDS for which eligible subsidy of Government of India will be made available. He informed that restriction in the export of coconut oil in bulk through Tamil Nadu and other southern ports has been relaxed. He further informed that more allocation of fund will be made to various schemes of the Board. Minister also instructed to submit separate proposal for enhancing subsidy pattern (25%) under TMOC and other schemes of Coconut Development Board.

About 200 coconut farmers from Coimbatore, Tirupur, Thanjavur, Theni, Kanyakumari, Vellore, Dindigul, Sivaganga, Madurai, Virudhunagar, Villupuram and Tiruvarur districts participated in the meeting.

Government of Maharasthra issues land lease agreement for DSP Farm, Thane

Shri. V.V. Limaye, Vice Chairman, receiving the land lease agreement from Shri. Prithviraj Chavan.

Government of Maharashtra issued the land lease agreement for the proposed Demonstration cum Seed Production Farm at Thane. Shri. V.V. Limaye, Vice Chairman, Coconut Development Board, reeived the lease agreement from Shri. Prithviraj Chavan, Chief Minister, Maharashtra. The proposed 100 ha. farm in Thane is expected to produce 1 lakh coconut seedlings. The tireless efforts of Shri. V.V. Limaye, Vice Chairman, CDB has made this dream of the Board come true.

Coconut investors' meet held

Shri. K.P. Mohanan, Agriculture Minister, inaugurating the Investors' Meet. Seen are: Shri. Subarto Biswas IAS, Shri. T K Jose IAS, Shri. K R Jyothilal IAS, Shri. P.T. Thomaskutty and Dr. P.V. Balachandran

In the wake of the severe crisis in coconut sector due to price fall, Government of Kerala will directly procure raw coconut from farmers from February 2013 onwards, said Shri. K.P. Mohanan, Minister for Agriculture, Government of Kerala. He was inaugurating the coconut investors meet held at Kochi on 2nd November 2012. Government has given in principle approval for neera tapping. He hoped that the Coconut Bio parks will be the stepping stone in the way forward of the coconut sector. The minister further said that as farmer security will ensure food security, the government is ready to formulate novel schemes for the benefit of the coconut farming community.

Shri. Subarto Biswas IAS, Agriculture Production Commissioner, Kerala in his presidential address assured the support of the government to committed coconut entrepreneurs. He emphasized the need for value addition in coconut and hoped that a handful of entrepreneurs would come up through the Coconut Bio Parks.

Shri. T K Jose IAS, Chairman in his keynote address said that the farmers are not realizing the high value of the crop and are selling the produce on a very low price. Lack of focused attention is making the sector to lag behind. There should be 10 coconut bio parks in 10 districts which are having more than 25,000 ha. area under coconut. He requested the state government to supply coconut oil through Public Distribution System and also to introduce coconut oil in mid day meal programme of schools. The sector is having the potential of say high and in 5 year's time we can even think of power stations generating power using coconut oil as bio fuel. He called upon the farmers and entrepreneurs to work together to make India the global leader in coconut production, productivity, value addition and export.

Shri. K R Jyothilal IAS, Principal Secretary (Agriculture), Govt. of Kerala, Shri. P.T. Thomaskutty, Executive Director, KSIDC and Dr. P.V. Balachandran, Director (Extn) Kerala Agriculture University spoke on the occasion. Shri. Sugata

O'fresh, cholesterol free fat free coconut water

O'Fresh' is fat free, cholesterol free coconut water offered in natural form by Yogic Foods Private Limited, Delhi. O'Fresh Coconut water contains 5 mg of natural sugar, 3 times the potassium level and 118mg of chloride which makes it far superior than any other sports drinks. The difficulty of getting coconut water in and around Delhi prompted the entrepreneurs to initiate such a venture. Lot of research was carried out and they found that there existed a huge market with dearth in supply. After extensive research on the location and machineries, the unit was successfully established. Yogic Foods Pvt Limited is planning to establish a tender coconut water preservation and packaging unit at Pollachi in Tamil Nadu. The product was displayed in INDEXPO held in Muscat and the product got a tremendous response.

A view of the participants

Ghose, Chief Coconut Development Officer, CDB delivered the welcome address and Shri. R. Prasanth, AGM, KSIDC proposed a vote of thanks.

The Investor meet in coconut processing sector on the theme, 'Product Diversification, Value Addition and Processing in Coconut-Future Outlook' was jointly organised by the Coconut Development Board, KSIDC and Department of Agriculture, Government of Kerala. Shri.Subrato Biswas IAS, Agriculture Production Commissioner, Kerala and Dr.P.V. Balachandran, Director (Extn.), KAU, chaired the technical sessions. Dr.K.Muralidharan, Director, Coconut Development Board, Shri. P.T Thomaskutty, Executive Director, KSIDC, Dr. K.Madhavan, Principle Scientist, CPCRI, Shri. Kumaraswamy Pillai, Dir (Mktg), Coir Board and Dr. K.Prathapan, MD, KERAFED spoke during the technical session.

Representatives of various banks spoke on the available schemes and had interaction with the entrepreneurs. DFRL, CFTRI, CPCRI, KAU and SCMS presented their coconut processing technologies.

Low fat nutritionally rich delicious fresh tender coconut cream

Apart from the accepted conventional and traditional concept about the nutritional value of coconut, now it is high time to change the taste concept for utilizing the nutritional value in a different perspective in this modern era of food habits. For this diversion, the Bio technology Department of the School of Communication and Management Studies has for the first time in India developed low fat cream from coconut. The endosperm and water of tender coconut is used for developing a low fat, high nutritious, health care product.

The cream is developed from tender coconut at its eighth month stage, when the proportion of the fat in the kernel is just 4 per cent. The fat level of this cream is lower than cow milk. The product will take two more years for it to be used for commercial production on a large scale and for export.

Rajasthan Trade Expo

Coconut Development Board, Market Development cum Information Centre, Delhi participated in Rajasthan Trade Expo 2012 organized by the India-International Trade Event Organisation (IITEO) and Dainik Bhaskar from 22nd to 30th September, 2012 at Jodhpur, Rajasthan. Shri Bhupendra Kumar Dak, Commissioner of Police, Jodhpur, Rajasthan inaugurated the expo in the presence of Shri Rajendra Solanki, Chairman, Jodhpur Development Authority.

A variety of samples of value added edible products made from coconut like virgin coconut oil, coconut milk powder, coconut milk,

A view of Board's Stall in Rajasthan Trade Expo

packed tender coconut water, vinegar, etc-, industrial products like activated carbon, shell charcoal, shell powder, coir products, etc; and utility and handicrafts made from different parts of coconut were displayed in the Board's stall. M/s. KLF Nirmal Industries and M/s. KERATECH had their sales cum display counter in the Board's stall.

Monthly operations in coconut gardens

December

Andaman & Nicobar Islands: Pile up soil into mounds in sandy and loamy soils. Hoe or plough in other types of soils.

Andhra Pradesh: Spray young seedlings affected with black-headed caterpillar (Opisina arenosella) with 0.05 per cent malathion or phosalone or 0.02 percent dichlorvos on the lower side of the leaves. Release stage specific parasites like Bethylid, (Goniozus nephantidis) for 3rd larval stage and Chalcidid (Brachymeria nosatoi) for early pupal stage. Larval parasitoid Braconid (Bracon hebetor) an pupal parasitoid Ichneumonid (Xanthopimpla punctata) can also be used as promising parasitoids. In multistage condition of the pest, combined release of all the parasitoids is required. When an initial insecticide treatment is given the parasitoids may be released only after three weeks of spraying. Treat red palm weevil affected palms by injecting 0.1 per cent dichlorvos or one per cent carbaryl. Depending on the intensity of pest infestation about 1-1.5 litres of insecticide suspension may be required for one palm. In the case of crown damage, the damaged tissues have to be removed and the insecticide suspension may be poured in. When pest entry is through the trunk all the holes on the stem may be plugged with cement or plaster of paris to avoid further damage of the tree from the pest attack. Harvest cowpea, raised as an inter crop in coconut garden. Plough the land and leave it fallow.

Assam: Irrigate the garden. Collect seednuts from selected mother palms and store them in shade in a cool, dry place. If rat damage is noticed organize a planned group action in the whole locality covering the residential houses and surrounding crop field including coconut and other horticultural gardens. Use poison baits, traps, etc. against rats. Fixing rat cones made of tin sheets on the trunk at a height of 2m above the ground will prevent the entry of rats on the palm. Clean the crowns of the palms periodically.

Bihar / Madhya Pradesh/ Chhattisgarh: Start irrigation depending upon the need. Keep the newly planted pits and basins of the palms weed free and remove the soil from collar region of the seedling. Protect young palms from winter scorching by providing suitable shade. Raise winter vegetable suited to the locality. Apply blitox @ 5g/ litre or dithane M-45 @ 2g/litre at the crown and bunches alternatively to avoid secondary infections due to cold injury and continue upto February.

Check the palms for termite attack. Drench the soil with 0.05 percent chlorpyriphos twice at 20 to 25 days interval. The affected trunk may be swabbed with the above chemical. Do not cut the green leaves and other living plant parts.

Karnataka: Irrigate young seedlings. Keep the nursery free of weeds and continue discarding of poor seedlings. If the attack of the mite is noticed, 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 per cent @4ml per litre or root feed azadiractin 5 per cent @ 7.5 ml with equal quantity of water. Collection of seednut from selected mother palm may be continued.

Kerala/Lakshadweep: Mother palms may be selected during the month for the collection of seednuts. Level down the mounds piled up earlier in the coconut garden. If the garden soil is sandy, add clay and if it is clayey add sand around the palms to improve the soil structure. Clear the irrigation channels. Clean the crowns of the palms periodically. Shade the newly planted and young seedlings. Apply sevidol 8G (25g) + fine sand (200 g) per palm in the topmost 2-3 leaf axils against rhinoceros beetle and

Nuts ffected by coconut mite

red palm weevil. Apply one-fourth of the recommended dose of fertilisers in the irrigated gardens. 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 @4ml per litre or root feed @ 7.5 ml with equal quantity of water.

Maharashtra/Goa/Gujarat: Plant yams as intercrop in the pits of 75 cm diameter and 15 cm depth spaced 100 cm apart. Before planting, fill the pits with farm waste and burn them. Level down the mounds piled up earlier in the garden.

Orissa: Seasonal intercrops may be sown. Irrigate coconut and the intercrops. Incorporate green manure. Coconut basins may be mulched with coir pith/ husk etc.

Plant protection chemicals may be applied according to the pest/ disease. If the attack of eriophyid mite is noticed root feed azadirachtin 5 per cent @7.5 ml with equal quantity of water. Clean the crown. Continue other maintenance operations to the intercrops as well as coconut.

Tamil Nadu/Puducherry: Treat all manure pits with carbaryl 50wp @ 0.01 per cent to destroy the grubs of rhinoceros beetle. Start irrigating the young seedlings. Keep the nursery free of weeds and continue discarding poor seedlings. Select mother palms for seednut collection. In areas where mite infestation is noticed, 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 per cent @ 4ml per litre especially on the perianth region of buttons and affected nuts or root feed azadiractin 5 per cent @ 7.5 ml with equal quantity of water.

Tripura: Irrigate the palms. Mother palms may be selected during the month for collection of seednuts for next year. Partial shade should be provided in south-west direction to the newly planted seedlings to prevent scorching.

West Bengal: Start harvesting of nuts. Treat the manure pit. Keep the nursery free from weeds. Continue discarding of poor seedlings. Irrigate the nursery once in a week.

Krishi Darsan Expo 2012

Coconut Development Board, MDIC, Delhi participated in Krishi Darshan Expo 2012 at Hisar from 5th to 7th October 2012. Shri. Ashok Tanwar, MP, Sirsa inaugurated the expo. Shri Balwinder Kumar, Additional Secretary, Ministry of Agriculture, Government of India and Dr.A.N. Meshram, Director, NRFMTTI were present during the occasion.

Board displayed samples of various brands of edible, industrial, utility, personal upkeep (including medicinal) and decorative products made from the 'Kalpavriksha' in the stall. The posters illustrating the goodness of various derivatives of coconut were displayed along with the Board publications.

The visitors were briefed on the various uses of different parts of coconut and the value added products made from coconut including its medicinal properties and industrial purposes. The prospects of marketing of packed tender coconut water, coconut chips, virgin coconut oil, desiccated coconut powder, coconut oil, etc. in Haryana and Punjab were highlighted to the visitors. 50 farmers from Thanjavur, Thiruvarur and Nagappattinam districts of Tamil Nadu visited this exhibition as part of exposure visit through Department of Agriculture, Government of Tamil Nadu. The farmers from traditional coconut growing states were enlightened about the schemes of the Board, need for value addition, necessity for forming Coconut Producers' Societies, FoCT and other aspects of coconut industry in the country.

Board's stall in Krishi Darshan Expo 2012

Board's publications were distributed to the visitors at Board's stall.

Dr. Meshram, Director, NRFMTTI had visited Board's stall and appreciated the Board's initiatives for the development of the coconut industry.

More than 15,000 people including farmers from different districts of Haryana, Punjab, and general public visited the expo.

Market Review - October 2012

Highlights

- The price of milling copra, ball copra and coconut oil expressed an upward trend at all the major markets during the month under report.
- The international price of coconut oil expressed a downward trend during the month under report.

The prices of copra and coconut ruled below minimum support price in major producing states and procurement activities were initiated by the Government machinery under Price Support schemes.

COCONUT OIL

The price of coconut oil quoted at all the major marketing centres in the country expressed an upward trend during the month under review.

The monthly average price of coconut oil at Kochi was Rs. 5761/- per quintal. The price of coconut oil at Alappuzha market also moved in tune with the price behavior of Kochi market. The monthly average price was Rs. 5739/- per quintal at Alappuzha market and Rs.5928 at Kozhikode market. The prices at Kochi, Alappuzha and Kozhikode markets were about 4 to 6 percent lower than the prices prevalent in September 2012. It is reported that lack of demand from upcountry buyers and local consumers also reflected in trading of coconut oil in Kerala At the same time, the low prices of other edible oils resulted in more availability of edible oils in the market.

MILLING COPRA

The monthly average prices of FAQ copra recorded at Kochi market was Rs.3987/- per quintal. The monthly average prices of Rasi copra at Alappuzha market was Rs.4032/- and at Kozhikode market was Rs.3919/- per quintal. The prices at Kochi, Alappuzha and Kozhikode were about 3 to 4 percent lower than that of the previous month. The procurement operations under Price Support Scheme have already been initiated in Tamilnadu and Kerala by TANFED and NAFED respectively. The Minimum support price of milling copra has been fixed at Rs. 5100/- per quintal for 2012 season. A total quantity of 23429 MT of copra was procured by Nafed through Tanfed in Tamilnadu and 13960 MT was procured in Kerala by Nafed through Kerafed and Marketfed. Around 6074 MT of copra was procured in Andhra Pradesh and 3350 MT in Lakshadeep.

The monthly average prices of milling copra at Ambajipeta market in Andhra Predesh was Rs.3923/- per quintal compared to Rs. 3688/- recorded during the previous month.

EDIBLE COPRA

The monthly average prices of Rajapur copra at Kozhikode market was Rs.5613/- per quintal, which was about 5 percent higher compared to the price in previous month.

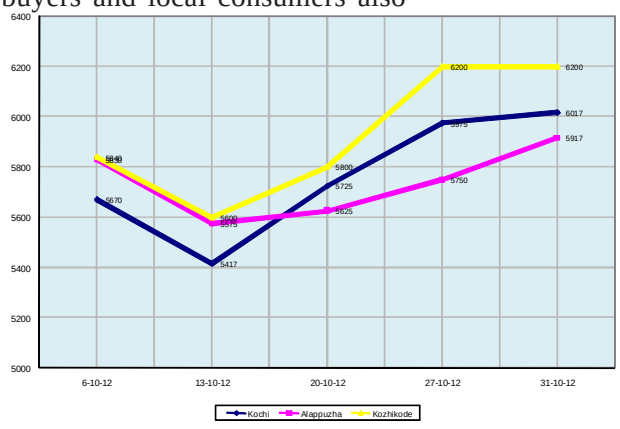
The monthly average prices of ball copra at Kozhikode market averaged at Rs. 4957/- per quintal.

The monthly prices of ball copra at APMC market Tiptur, in Karnataka averaged at Rs. 5109/- per quintal in October 2012 while it was Rs 5800/- in Bangalore and Rs. 5087/- in Arsikere.

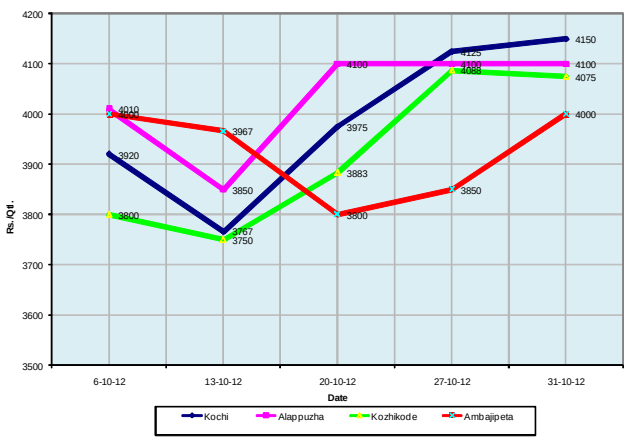
The Minimum support price of edible copra has been fixed at Rs. 5350/- per quintal for 2012 season.

DRY COCONUT

The monthly average price of dry coconut was around Rs. 4265/- per thousand nuts at Kozhikode



Price behaviour of coconut oil during October 2012



Price behaviour of milling copra during October 2012

market which was about 6 percent lower than that of the previous month.

COCONUT

The monthly average price of Rs.5500/- per thousand nuts for dehusked coconut at Nedumangad market remained the same as that of the previous month.

Arsikere APMC market recorded an average of Rs.5417/- for thousand partially dehusked nuts which was about 6 percent lower than that of previous month.

The monthly average prices of partially dehusked coconut at Bangalore APMC market was Rs. 6900/- which was marginally lower than that of previous month.

The monthly average price of partially dehusked coconut Grade-1 quality at Mangalore APMC market improved to Rs.9600/- per thousand nuts which was about 4 percent lower than that of the previous month.

The monthly average price of coconut in Assam was Rs.16 per nut while it was Rs.50 at Aizawl in Mizoram and Rs.21 at Dimapur in Nagaland.

The Government of India has declared the Minimum Support price of dehusked mature coconut with water at Rs. 14/- per kg.

TENDER COCONUT

Price of tender coconut at Kochi market ranged from Rs.15-25/- per nut. The monthly average price of tender coconut in Assam was Rs.18 per nut and Rs.18 at Dimapur in Nagaland while it was Rs.44 at Aizawl in Mizoram.

INTERNATIONAL PRICE

The monthly average price of US$905 per MT for coconut oil in Europe (C.I.F. Rotterdam) for the month of October 2012 was about 7 percent lower than that of the previous month and lower by about 25 percent than that of the corresponding month last year. The monthly average price of US$ 588 per MT for copra was about 6 percent lower than that of the previous month and about 51 percent lower than that of the corresponding month last year.

The domestic price of coconut oil during the month of October 2012, in Philippines was US$905 per MT and in Indonesia; the price was US$726 per MT. The international price of Palm oil, Palm kernel oil and Soybean oil were US$850, US$882 and US$1179 per MT respectively.

Monthly average prices of Mature nut, Tender nut and Ball copra in North Eastern Region during the month of October 2012.

	ASSAM							NAGALAND	MIZORAM	TRIPURA
Products	**Guwahati**	**Nelbari**	**Nagoan**	**Sonitpur**	**Darrang**	**Karimganj**	**Silchar**	**Dimapur**	**Aizawl**	**Agarthala**
Mature nuts (in Rs./ nut)	13	19	20	18	21	22	25	21	50	12
Tender Nuts (in Rs./ nut)	11	15	8	21	17	18	25	18	44	11
Ball Copra(in Rs./ Kg.)	90	130	NR	165	95	120	160	120	120	95

Market Price

Date	Coconut Oil			Milling Copra				Edible Copra	Ball Copra				Dry coconut	Coconut	Partially dehusked coconut		
	Rs./ Qtl.												Rs./ 1000 nuts				
	Kochi	Alappuzha	Kozhikode	Kochi (FAQ)	Alappuzha (Rasi Copra)	Kozhikode	Kakala	Kozhikode	Kozhikode	Tiptur	Bangalore	Arsikere	Kozhikode	Nedumangad	Arsikere	Bangalore	Mangalore (Grade-1)
6-10-12	5670	5830	5840	3920	4010	3800	4000	5250	4720	4865	5800	4890	4160	5500	5600	7000	9600
13-10-12	5417	5575	5600	3767	3850	3750	3967	5221	4642	4844	5800	4793	4000	5500	5633	7000	9600
20-10-12	5725	5625	5800	3975	4100	3883	3800	5567	4925	5188	5800	5156	4067	5500	5417	6900	9600
27-10-12	5975	5750	6200	4125	4100	4088	3850	5825	5100	5312	5800	5302	4200	5500	5283	6800	9600
31-10-12	6017	5917	6200	4150	4100	4075	4000	6200	5400	5337	5800	5293	4900	5500	5150	6800	9600
Average	5761	5739	5928	3987	4032	3919	3923	5613	4957	5109	5800	5087	4265	5500	5417	6900	9600

Source: **Kochi:** Cochin Oil Merchants Association and Chamber of Commerce, Kochi - 2, **Kozhikode:** The *Mathrubhumi* daily **Alapuzha:** The *Malayala Manorama* daily, **Arsikere :** APMC, Arsikere
Price quoted for *office pass* copra at Kozhikode and *Rasi* copra at Alappuzha markets. NT : No transaction