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From the desk of Chairman

Dear Coconut Farmers,

Indian coconut sector has great potential to absorb technologies in order to improve its contributions to its stakeholders. There are challenging issues to be addressed in time. Despite vigorous efforts, occurrence of unproductive palms in traditional coconut growing states is one of our prime concerns. To address this problem, India is the first country to start and implement a massive scheme; “Replanting and Rejuvenation of Coconut Gardens” under Mission for Integrated Development of Horticulture (MIDH). The scheme was first introduced in Kerala, the state with the longest history of coconut cultivation where one third of the palm population was old and senile. Apart from this, coconut cultivation in the state was under the grip of a debilitating disease, root wilt. Cutting followed by removal of disease advanced palms and employing improved management care to the existing palms has proved as an effective strategy to manage the gardens.

CDB is implementing “Replanting and Rejuvenation” programme in Kerala since 2009-10. So far 3.5 lakh ha. area has been covered in 14 districts of the state. Coconut Development Board has provided financial support of around Rs. 304 crores to implement this scheme. So far 38 lakh palms have been replaced with high quality seedlings. This is expected to reduce the source of inoculums and prevent the spread of root wilt disease in Kerala. Besides, adoption of better management practices would help to improve the productivity of coconut in the state in future. The same scheme is now being extended to the states of Tamilnadu and Karnataka.

The programme involves huge financial involvement and active participation of farmers and other stakeholders. Adoption of rejuvenation package recommended under different components of the programme is vital to achieve the targeted objectives of the programme. I request the coconut farmers to take benefit of this programme to improve the productivity of the palms.

With warm regards,

A K Singh

A handwritten signature in dark ink, appearing to read 'A K Singh'.

Chairman

Drip irrigation for sustainable coconut farming - institutional and technology perspectives

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A substantial area under coconut farming in India, especially in states like Kerala is rainfed and the total quantity and pattern of distribution of rainfall directly influences coconut production in such areas. Even though coconut palms tolerate wide range in intensity and distribution of rainfall, a well distributed rainfall of about 2000 mm per year is best for proper growth and higher yield. In areas of inadequate rainfall with uneven distribution, irrigation is required. During 2016, out of the total of 36 meteorological sub-divisions in the country nine sub divisions including four sub divisions from the south peninsula (Kerala, coastal Karnataka, south interior Karnataka and Lakshadweep) received deficient rainfall during the south west monsoon season. The actual rainfall received in Kerala during the south west monsoon (1st June - 30th September) was 1352.3 mm as against the normal rainfall of 2039.7 mm showing (-) 34 per cent departure from the normal. The deficiency in rains continued during the north east monsoon season also. The departure was (-) 62 per cent from the normal. The pre-monsoon showers received in Kerala state from 1st March to 31st May, 2016 also showed a departure of (-) 18 per cent from the normal.

The deficient rainfall in both the monsoon seasons will adversely affect coconut production. Hence, concerted efforts are required to mitigate the adverse impact of deficient rains. Adoption of soil and moisture conservation measures is essential, especially in rainfed coconut gardens. Further, adoption of water saving technologies such as drip irrigation is highly recommended in water scarce localities of coconut farming.

Drip irrigation is ideally suited for widely spaced crops like coconut as it saves water, energy and labour. The water use efficiency is also high. Based on studies conducted at CPCRI, it was concluded that yield of

coconut with drip irrigation daily @ 66 % of the evapo-transpiration from December to May was adequate and comparable to basin irrigation @ 200 litres palm once in four days. Thus, there is 34 per cent saving of water in drip irrigation. This is applicable to varieties and hybrids and also in different soil types. The number of dripping points should be six for sandy soils and four for other soil types. The rate of water application should be 2-3 litres per hour per emitter (Fig 1).



Farmers came to be aware of the drip irrigation technology for coconut only during the early 1980s and consequently many coconut growers have installed drip irrigation system in their gardens. Government also implemented programmes that encouraged farmers to adopt water conserving microirrigation technology, by

providing subsidy and other incentives. Effective field implementation of drip irrigation technology will help the farmers in the judicious use of scarce water resources for enhancing the productivity of coconut.

Adoption of recommended practices of drip irrigation

The results of a study conducted at CPCRI Kasaragod revealed that about one-fifth of the farmers, who had installed the drip irrigation system in their coconut gardens were under the category of low level of adoption of recommended practices of drip irrigation technology. This indicates that even the adopters of a farm innovation did not follow all the practices recommended for effective field implementation of the technology. Further, it also emphasizes the need to plan and implement appropriate educational efforts for enhancing the adoption of recommended practices by the farmers who had already implemented the drip irrigation technology in their orchards.

The summary of results of the analysis of adoption of various recommended practices of drip irrigation technology in coconut farming by the farmers are presented in Table 1.

S. No.	Item	Percentage of adopters	Rank
1.	Selecting pumping unit with suitable capacity	78.00	IV
2.	Method of water supply	42.50	V
3.	Volume of water applied per palm per day	2.00	X
4.	Number of dripping points	28.50	VI
5.	Location of dripping points	10.00	IX
6.	Placement of dripping point	2.00	X
7.	Root zone area wetted	1.50	XI
8.	Ensuring field uniformity	81.50	III
9.	Type of emitter used	95.00	II
10.	Type of filter used	96.50	I
11.	Flushing of pipelines	24.00	VII
12.	Backwashing	17.50	VIII
13.	Fertigation	0.00	XII

Adoption of recommended practices of microirrigation technology in coconut farming presented in Table 1 indicate that type of filter used, type of emitter used and ensuring field uniformity ranked I, II and III respectively based on the extent of adoption. It is worthwhile to note that the item on fertigation got an adoption index of zero,

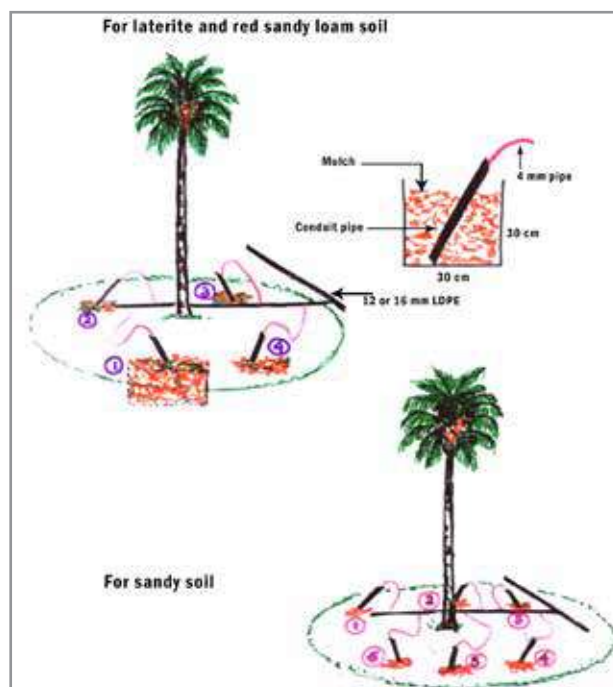


Fig 1. Drip irrigation layout in the coconut basin

and hence ranked last among the items, as none of the farmers adopted the same in their drip irrigation unit. Volume of water applied per palm per day, placement of dripping point and root zone area wetted were the other items which had low adoption scores.

From the foregoing results, it could be concluded that there is wide variation in the extent of adoption of the selected items of recommended practices of microirrigation technology in coconut farming. Very low adoption indices of some of the recommended practices indicate that much emphasis has to be given for creating awareness among farmers about the recommended practices of microirrigation technology in coconut farming. Demonstration farms could be established in innovative farmers' plots with the active participation of stakeholders and local leaders. These successful farmers would serve as local examples for the neighbourhood to follow. Further, adequate attention has to be paid at the time of field installation to ensure that the recommendations for effective field performance are taken care of.

Selecting pumping unit with suitable capacity:

About three-fourth of the microirrigation systems installed were having pumping unit of suitable capacity, while the remaining were having pumping units with inappropriate capacity. The purpose of pump in an irrigation system is to pump a desired quantity of water at sufficient pressure. Both the discharge rate and pressure head and the pressure requirement vary according to location and type of irrigation. The selection of pump

should be made accordingly. Each pump gives its best performance at a particular discharge and against a given pressure head. Inappropriate selection of pumping units would reduce the efficiency of irrigation and also results in wastage of resources.

Method of water supply: The recommended method of water supply is by direct pumping, as it provides a uniform and required operating pressure and discharge. It was observed that many farmers opt for providing water for drip system through overhead tanks because the overhead tanks constructed serve both domestic as well as irrigation purposes.

Volume of water applied per palm per day: For coconut under drip irrigation, the recommendation is to apply irrigation water @ 66 per cent of open pan evaporation. With the prevailing climatic conditions in the study area this is approximately 32 litre of water per day per palm. The present study revealed that a vast majority of the farmers were irrigating their coconut palms with more than the recommended quantity of water. Only two per cent of the farmers were using the recommended level of water through their microirrigation system. A similar percentage of farmers used below the recommended quantity of water. The major advantage of microirrigation system is saving the precious resource of water required for irrigation. The purpose of adoption of water saving technology of microirrigation will be defeated if farmers use more than the required quantity of water through microirrigation.

Number of dripping points: The present recommendation is to provide four dripping points in sandy loam and laterite soils and six dripping points in sandy soil for coconut to obtain a minimum of 30.00 per cent of the root zone area to be wetted. But the results showed that only 14 out of 44 drip irrigation systems installed in coconut gardens under sandy loam soil and 43 out of 130 under laterite soil type were having the recommended number of dripping points per palm. None of the drip irrigation units installed in coconut gardens grown in sandy soil were having the recommended number of dripping points per palm. If the recommended number of dripping points per palm are not maintained, proper wetting of root zone will not be achieved and also the loss of water through percolation will be more. At the stage of field installation of microirrigation system, care should be taken to provide adequate number of dripping points per palm so as to ensure maximum benefits from microirrigation technology.

Location of dripping points: In coconut, the present recommendation is to keep the dripping point at a distance of 1m away from the palm. This is to obtain maximum wetted soil within the root zone. But from the results obtained, it could be seen that in a vast majority of coconut gardens, the distance of dripping point from



tree trunk was less than the recommended distance. On enquiry, it was found that most of the non-adopters were not aware about the importance of keeping the dripping points at the recommended distance in the coconut basin. Further, the cultivators did not get involved much during the installation of the system in their orchards, as the work was mostly done by the personnel representing the firm supplying the microirrigation equipment. The non-adoption of recommended location of dripping point in the basin of coconut palm adversely affects the proper wetting of soil. Hence, to ensure maximum benefits from microirrigation technology in coconut farming, it is necessary that proper care is taken at the stage of field installation of microirrigation system to have the location of dripping points in the basin at the recommended distance from the trunk of coconut palms.

Placement of dripping point: Experiments at CPCRI showed that sub-surface application of water would help to reduce the evaporation from soil surface. Results showed that vast majority of farmers of the study area kept the dripping points on the surface itself. Surface placement of dripping points definitely result in loss of water through evaporation. This points to the need to make efforts to create awareness among the farmers adopting drip irrigation system about the need and importance of proper placement, i.e., subsurface placement to minimize the water loss.

Root zone area wetted: As per the guidelines for effective irrigation through drip system, a minimum of 30 per cent of the root zone area should be wetted in drip irrigation. Results of the study furnished showed that in majority of the coconut gardens, the recommended level of root zone area of palms were not getting wetted. As a result of inappropriate method of adoption of items like



number of dripping points, location of dripping points as well as placement of dripping points, the root zone area wetted is less than the recommended level. Hence efforts should be made to motivate the farmers to adopt all the items of microirrigation technology for achieving better results.

Type of emitter used: A vast majority of the farmers were using micro tube as emitters in their drip system. Pressure compensating type of emitter, which is the ideal type, was used by only a few. The pressure compensating type of emitter is costly and that may be the reason for the very low rate of adoption. However, micro tube also would give satisfactory level of performance of the system. Few other farmers used non-pressure compensating type of emitters which is not recommended as it would not ensure the required emission uniformity in the field.

Type of filter used: Filters are essential components of drip irrigation system to prevent or minimize emitter clogging. Different types of filters are available for use in the drip irrigation system. Majority of the drip irrigation units installed in farmers' field were having the ordinary wire mesh filter type. Few farmers adopted sand filter, which are effective in removing light suspended materials such as algae, fine sand, silt particles etc., but costly. When good quality water is used for irrigation, ordinary wire mesh filter is sufficient for use in the drip irrigation system. There were few drip irrigation units in farmers' field where no filter mechanism was fitted. If no filters are used, the efficiency of the microirrigation system will be adversely affected due to clogging.

Flushing of pipelines: Flushing of pipelines of the drip irrigation system is done for cleaning the pipelines to ensure better flow of irrigation water. It is recommended to flush the pipelines immediately after installation. All the pipelines, viz., main, sub-mains and laterals are to be flushed one by one. After the initial installation, flushing needs to be repeated every month. Non-adoption of

proper flushing adversely affects the field performance of the microirrigation systems installed in farmers' field.

Backwashing: Backwashing is done to clean the filtration system. It is done by reversing the direction of the flow of water through the filter for 5 to 10 minutes before the commencement of irrigation. Frequency of backwashing depends on the sediment quantity in the irrigation water. If more impurities are there in the water, backwashing is to be done daily. Study showed that in majority of the microirrigation units installed in farmers' field, backwashing was not adopted. Non-adoption of recommended practice of backwashing adversely affects the field performance of the microirrigation systems installed in farmers' field.

Fertigation: The process of adding fertilizers to the drip system is called fertigation. The advantages of this practice include achieving higher fertilizer use efficiency, saving labour for fertilizer application, etc. In this study, it was observed that none of the farmers adopted fertigation practice for his coconut palms through the drip irrigation system installed in his garden. In advanced countries, farmers widely utilize drip irrigation system for fertilizer application (fertigation) to the crops. Indian farmers are yet to exploit this conservation technology for achieving better fertilizer use efficiency.

Constraints in the operation and maintenance of drip irrigation system

The perception of farmers about the constraints in the operation and maintenance of drip irrigation system in coconut gardens is summarized in Table 2.

Table 2. Perception of farmers about the constraints in the operation and maintenance of drip irrigation system (n=200)

S. No.	Item	Total score	Rank
1.	Clogging of the system due to impurities in irrigation water	220	I
2.	Improper after sales service	188	II
3.	Lack of timely technical guidance from the extension personnel	170	III
4.	Low level of awareness and inadequate knowledge about utility, method of operation and maintenance	156	IV
5.	Erratic electric power supply	144	V
6.	Voltage problem	132	VI
7.	Damage of pipelines and drippers by wild animals such as wild boar etc.	129	VII
8.	Damage of pipelines and drippers by rats	119	VIII
9.	Damage of pipelines and drippers by falling coconut leaves	112	IX
10.	Root concentration on soil surface	105	X

Clogging of the drip irrigation system was the most important problem faced by the cultivators. Emitter clogging continues to be the major problem associated with the drip irrigation operation. The causes for clogging, which is directly related to the quality of irrigation water may be physical, chemical or biological factors. Even though standard recommendations are available to prevent clogging, farmers were found unaware of these practices. Lack of timely service from dealers was the second important constraint in the proper operation and maintenance of the microirrigation system as perceived by farmers. Farmers are to be provided the required after sales service in time so that the microirrigation system installed in their coconut garden is functioning properly and fetch the desired level of benefits to the farmers. Poor technical guidance from extension personnel was ranked third among the constraints experienced by farmers. It is imperative that the functioning of 'Krishibhavan', which is the focal point of agricultural development and extension at panchayat level in Kerala State, needs to be streamlined for providing better quality of extension service to the farmers. Low level of awareness and inadequate knowledge about utility, method of operation and maintenance of the microirrigation system was ranked fourth among the constraints. Erratic electric power supply, voltage problem, damage of pipelines and drippers by rodents and wild animals, damage caused by falling coconut leaves and root concentration on soil surface were the other constraints in the operation and maintenance of drip irrigation system.

Farmers' participation in the procurement, installation and operation and maintenance of drip irrigation systems

Study revealed that the extent of participation of farmers in most of the activities related to the initial procurement of microirrigation systems was fairly good. But the extent of participation of farmers was very low with respect to the activity that followed ; i.e. actual field installation of microirrigation systems in coconut gardens. The field installation of the system



required high technical skill and only trained personnel can properly install the system in tune with the specific features of the plot. Hence farmers are to be made aware of the requirements and steps involved in the proper installation of the microirrigation system. For this, effective participation of farmers should be ensured in the field installation. Similar was the case with the activity related to the timely repair and maintenance, in which extent of participation was low. The situation calls for strengthening efforts to create awareness among the farmers about the importance of their quality participation in the field implementation and subsequently to impart the required knowledge and skill to the farmers for the effective field implementation of microirrigation technology.

Conclusion

A considerable proportion of farmers who had installed the drip irrigation system in their coconut gardens are not following the recommended practices of adoption of different aspects of the technology. And they do not possess the required level of know-why and know-how aspects, resulting in less effective field implementation of the technology. Hence there is a need to plan and implement appropriate educational efforts for enhancing the adoption of recommended practices by the farmers who had already implemented the technology in their orchards. Adequate attention is also to be paid to organise educational programmes by the extension agencies to enhance the knowledge level of farmers adopting drip irrigation on the proper field implementation of the technology. While organising educational programmes on microirrigation technology, emphasis should be given on topics such as fertigation, location of dripping points, placement of dripping point etc. The extent of participation of farmers was not at a satisfactory level with respect to the activities related to the field installation and maintenance of drip irrigation systems in coconut gardens. Hence efforts are to be made to create awareness among the farmers about the importance of their quality participation in the field implementation. ■



Coconut based farming system for livelihood and nutritional security

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1. Introduction

Coconut is a traditional plantation crop of India and assumes the status of a high value commercial crop and Kerala ranks first in area (53.76%) followed by Tamil Nadu, Karnataka and Andhra Pradesh. In our country, 98% of the coconut holdings are less than 2.0 ha in size out of which more than 90% are less than 1.0 ha. these small holdings are mainly committed to a mono crop of coconut, which normally occupies the land for about a century. Most of these holdings neither provide gainful employment opportunities for the family labour throughout the year nor generate sufficient income to meet the family requirement. In the present condition where coconut growers are more exposed to economic risks and uncertainties owing to the high degree of price fluctuations, need of the hour is to emphasize the importance of crop diversification in coconut gardens.

Coconut gardens offer excellent opportunities to exploit the inter-space potential for maximizing returns per unit area. In humid tropics, cropping/farming system aims at crop diversification and intensive cropping in the inter space available in coconut to increase the per palm productivity as well as productivity of unit holding in a system approach wherein the available farm resources like soil and water/rainfall resource, farm labour, agricultural inputs (seeds, fertilizers, agro-chemicals) etc. are utilized to produce both nuts, food and non-food agricultural products from the farm, in a business or profitable way. Under such a cropping/farming system, all the management practices and component production systems should be able to maintain high productivity, profitability and sustainability of the existing coconut palms to maximize economic yield of the farm. Sustainability is the main objective of farming system, where production process is optimized through efficient utilization of the inputs in safeguarding the environment.

2. Scope of coconut based cropping/ farming system

Studies have revealed that planting method and growth habit of sole coconut palms at the recommended spacing of 7.5 m x 7.5 m make use of only 22.3% of land area effectively while the average air space utilization by the canopy is about 30% and solar radiation interception is 4550%. However, the effective root zone of the adult palm is confined laterally within a radius of 2 m around the base of the palm and over 95% of roots are found



Fig. 1. Cocoa under coconut as a understory crop



Fig.2. Oranmental crops under coconut as intercrop



Fig.3. Coconut based high density multiple cropping system



Fig.4. Banana as inter crop

in the top 0-120 cm of which 18.9 % and, 63 % of roots are confined to top 0-30 cm and 31-90 cm depth, respectively. Making use of the underutilized soil space and solar radiation in pure stands, a variety of crops having different stature, canopy shape and size and rooting habit can be inter planted to form compatible combinations.

3. Relevance of Coconut Based Cropping/Farming Systems (CBCFS)

The practice of CBCFS can provide:

- Food security through food sufficiency
- Nutritional foods rich in vitamins and minerals (nutrients) through inclusion of vegetables, fruit crops, tuber crops, spice crops etc.
- Employment generation from farm diversification
- Ecological stability (environmental protection) by way of crop diversity and effective recycling of farm wastes).

3.1. Social benefits: Social benefits are the food and nutritional functions of fresh nuts of coconut and coconut products, and crops produced under Coconut Based Cropping/Farming System (CBCFS) which include; cereals (as source of carbohydrates, protein, fats and oils); root crops (as source of carbohydrates and minerals); legumes (as source of protein and vegetable fats and oils); fruit crops (as rich source of vitamins and minerals, and carbohydrates); leafy and fruit vegetables (as rich source of vitamins, minerals and dietary fibres); spice crops (food flavouring, and vitamins and minerals); coffee and cocoa (beverage and stimulants) and natural fibre crops (clothing materials and paper and packaging); wood and timber (housing materials, pulp and paper).

3.2. Ecological benefits: Ecological conditions of the long-term mono cropping land compared to the CBCS lands indicated the favourable and stable intensive and sustainable agricultural production under latter. Ground covering through cover cropping minimizes the direct impact of rainfall and the separation of soil aggregates under a coconut environment, which can

control soil erosion by 70-90%, compared to bare soil or un-cropped condition. The micro climate in coconut garden allows other crops or plants to grow favourably between spaces of palms. The presence of undergrowth vegetation in coconut plantations minimizes soil and water loss through surface runoff. An adequate ground cover can also increase rainwater infiltration and storage, eventually increasing water supply of the entire area, and reducing the runoff and soil loss.

Thus, totals of CBCS environmental value will be (Soil conservation+ Farm diversification +Nutrient recycling+ Fuel energy). Generally, the value of the coconut based agro-ecosystem is based on the direct use as food, raw materials and fuel, but the services rendered by the ecosystem should also be covered.

4. Coconut based cropping/ farming systems

In order to enhance productivity per unit land area, we have to make maximum use of limited resources without affecting the ecological balance in any manner. The ideal approach for small farmers towards this would be to increase the cropping intensity, which can be achieved through two ways, the first being the time concept where instead of taking only one crop, more crops per year are cultivated and harvested and the second being space concept, where all the available space in between the main crop is used for cultivation of various crops.

Coconut based cropping/farming systems have received priority in India in recent years and accordingly, research programmes on coconut based cropping systems were initiated during the thirties at the Coconut Research Stations at Kasaragod, Pilicode and Nileshwar and were intensified in the seventies with the establishment of Central Plantation Crops Research Institute at Kasaragod and All India Coordinated Research Project (AICRP) on Palms with centers in different coconut growing states. A number of coconut based cropping systems involving annuals, biennials, perennials and combinations of both annuals and perennials have been developed to



Fig.5. Pineapple under coconut



Fig.6. Grass under coconut

suit the farmers' needs, availability of resources like labour, rainfall, irrigation facilities, finance etc., soil characteristics and market demand. The crops found suitable for cultivation as subsidiary crops in coconut gardens include tuber crops, rhizome spices, cereals, pulses, oilseeds, fruit crops, vegetables, and medicinal and aromatic plants among the annuals and beverage crops and spices among the perennials. The research effort of ICAR-CPCRI has resulted in the development of technologies for coconut based intercropping, multi-storied, high density multi-species cropping systems and these are being widely adopted by the farmers. The high density multi-species cropping system and coconut-based mixed farming system, involving annuals/biennials/perennials grown in different tiers by exploiting soil and air space more efficiently and integrating with poultry and animal husbandry, help to maximize profits and can even buffer the price crash of the main crop. The crops selected for a cropping system should be compatible with the main crop and it should have local demand.

4.1. Coconut based High Density Multispecies Cropping Systems (HDMSCS): The HDMSCS is the growing of number of compatible crops in a unit area to meet the diverse needs of a farmer and this system aims at maximizing production per unit of land area and is ideally suited for smaller holdings. The sustainability of production is well addressed in this system through

efficient utilization of natural resources and biomass recycling. HDMSCS models consist of a large number of crop species that include annuals, biennials and perennials with very high plant density. The crops selected will have large, medium and small canopy architecture and are planted in a systematic manner to exploit space both in the vertical and horizontal dimensions. The disturbance to soil is to be kept to the minimum (only slash weeding is done) and all the biomass (other than the economic part) produced is also to be recycled within the system. Cash, food and fodder crops are generally included in the cropping system. The annual crops are removed as the canopy size of perennial crops increases.

4.2. Productivity and Economics of HDMSCS:

The productivity of land increases in the high density multispecies cropping system due to crop diversification and intensification. HDMSCS at ICAR CPCRI, Kasaragod with coconut + black pepper+ nutmeg + banana+ pineapple+ annual crops like ginger, turmeric has resulted in higher system productivity and income. The coconut yield realized during 2014-15 under different nutrient management system was 177 to 188 nuts/palm/year compared to the pre-experimental yield (2005-07) of 142 to 152 nuts/palm/year. The economics of the system for the year 2014-15 indicated higher net return in applying fully organic with recycling biomass (vermicompost)+biofertiliser+green manuring+vermiwash+husk burial+mulching) (Rs. 3.55 lakhs/ha/year) followed by other nutrient management treatments (Rs. 3.30 lakhs/ha/year). The results of the studies on HDMSCS conducted during 2008 to 2015 at different Centres of AICRP on Palms located in different parts of the country have indicated improvement in coconut yield and productivity of the land. The coconut based cropping systems under integrated nutrient management evaluated at different AICRP Centres also showed higher productivity and income than mono crop of coconut. At Aliyamagar (Tamil Nadu) Centre, the cropping system of coconut + cocoa + banana + pineapple with integrated nutrient management of 75% of recommended NPK coupled with organic recycling with vermicompost recorded higher net income of Rs. 3.77 lakhs/ ha followed by fully organic treatment (Rs. 3.46 lakhs/ha), whereas, mono crop of coconut recorded the lowest net income (Rs. 1.24 lakhs/ha). At Arsikere (Karnataka) Centre, the cropping system of coconut + cocoa + lime + drumstick recorded higher net returns under fully organic nutrient management (Rs.2.95 lakhs/ha) followed by 50% of recommended NPK + organic recycling with vermicompost + vermiwash application + biofertilizer application and in situ green manuring (Rs. 2.84 lakhs/ha), whereas, mono crop recorded the lowest net income (Rs. 1.10 lakhs/ha). At Ambajipeta



Fig.7. Dairy unit associated with coconut

(Andhra Pradesh) also, the HDMSCS with cocoa+ banana+vegetables+ pineapple resulted in realizing higher income (Rs. 2.75 lakhs/ha), whereas, mono crop recorded only Rs.1.25 lakhs/ha indicating the financial advantage of HDMSCS over mono cropping coconut.

4.3. Coconut based Integrated Farming System (CBIFS): The sustainability and profitability of coconut based integrated farming system comprising coconut, black pepper trailed on the coconut trunk, banana in the border of the plots, fodder grass (Hybrid Bajra Napier Co 3) in the interspaces of coconut, dairy unit (seven cows of Holstein Friesian and one Jersey cross breed), poultry (100 broiler birds/batch), Japanese quails (100 layers) and aquaculture (1000 finger lings) are assessed in a coconut stand of 40 years old maintained in the soil type of sandy loam of ICAR-CPCRI, Kasaragod. The coconut palms maintained under CBIFS receiving integrated nutrient management practices i.e., organic recycling and 50% of the recommended chemical fertilizer recorded higher coconut yield (140 nuts/palm) which was comparable with other nutrient management practices and also higher than coconut mono cropping (114 nuts/palm). The integrated farming system improved the soil fertility, physical properties of soil viz., bulk density, water holding capacity and hydraulic conductivity which are required for sustainability of the system. Hybrid Bajra Napier CO 3 and Co 4 as intercrop in coconut resulted in average yield of 117 t and 114 t green fodder /ha/year, respectively. Such a coconut based farming system resulted in the net returns of Rs 5.18 lakhs /ha during the year 2014-15, which indicates the profitability of the system.

4.4. Role of Coconut Based Cropping/Farming System in Root (wilt) affected garden: Root (wilt) of coconut is a debilitating disease and there is no effective prophylactic or curative measure for this disease as it is caused by phytoplasma. Those palms, affected by the disease, often, are seen superimposed with leaf rot disease also, and if left unattended, the disease will advance and cause drastic reduction in nut yield. The net return from the disease affected area is comparatively low due to the poor yield of coconut and also due to the additional expenditure to be incurred on plant

protection operations to combat the leaf rot disease. In such a situation, where the income from the main crop is declining, the agronomic strategy has to be oriented to evolve a suitable inter/mixed/multi-storied cropping programme, which will ensure a reasonable income to the farmer from the land. Various studies conducted on CBCS or CBFS through HDMSCS in root(wilt) disease affected areas have clearly indicated the beneficial role in improving total productivity of the land (by way of enhancing coconut yield, additional yield from inter/mixed crops, thereby ensuring nutritional security), as well as providing additional employment opportunities to the farm family. The crops included, besides coconut were banana, pineapple, black pepper, elephant foot yam and vegetables. The contribution from various inter/mixed crops varied from 30 % to 50% in different years indicating that fall in price of main crop(coconut) could be compensated to a great extent by other crops in the system. The biomass available in the field could be effectively recycled to meet the nutritional requirement of the system, though partially, which will also improve physico-chemical and biological properties of soil paving way for improving the production efficiency of the system. Recent studies in the root(wilt)disease affected coconut gardens have proved the potential of intercropping flower crops such as *Heliconia stricta* Iris and sequential cropping of *Tagetes* (seven months) followed by *Gomphrena* (five months) (both being short duration crops) in improving the yield of coconut palms as well as increasing the economic returns.

4.5. Productivity and Economics of the System in Littoral Sandy Soil:

The littoral sandy soil constitute a major portion in the coconut growing regions. Fodder grass (Hybrid Bajra Napier ,Co3- 92 t/ha/year), vegetable crops (cowpea-6 t/ha, ridge gourd-9 t/ha, snake gourd- 8t/ha), pumpkin-10.12 t/ha and ash gourd-(9.2 t/ha), tuber crops (elephant foot yam- 20t/ha)) and fruit crops (banana and pineapple-15t/ha)) could be successfully grown as intercrops in coconut gardens under coastal sandy soil by adopting appropriate soil moisture conservation measures viz., opening of trenches/ pit depending upon the crops chosen and incorporation of one layer of coconut husk in the bottom of this trench/pit with its



Fig.9. Tuber crops under coconut



Fig.9. Vegetable under coconut

concave surface facing planting zone and this husk layer is covered with organic manure which is covered by soil. The yield of coconut could be increased from initial level of 40 nuts/palm to 120 nuts/palm under coconut + vegetable intercropping system followed by coconut + pineapple (107 nuts/palm), coconut + fodder grass (102 nuts/palm) and mono cropping (98 nuts/palm) during 2014-15. The economic advantage of the system under coastal sandy soil is that all the cropping systems had realized higher net returns as compared to mono crop. The net returns ranged from Rs. 0.46 lakh/ha/year in case of coconut mono crop to Rs. 1.13 constitute a major portion in the coconut growing regions. Fodder grass (Hybrid Bajra Napier, Co3- 92 t/ha/year), vegetable crops (cowpea-6 t/ha, ridge gourd-9 t/ha, snake gourd-

8t/ha), pumpkin-10.12 t/ha and ash gourd-(9.2 t/ha), tuber crops (elephant foot yam- 20t/ha)) and fruit crops (banana and pineapple-15t/ha)) could be successfully grown as intercrops in coconut gardens under coastal sandy soil by adopting appropriate soil moisture conservation measures viz., opening of trenches/ pit depending upon the crops chosen and incorporation of one layer of coconut husk in the bottom of this trench/ pit with its concave surface facing planting zone and this husk layer is covered with organic manure which is covered by soil and planting taken. The yield of coconut could be increased from initial level of 40 nuts/palm to 120 nuts/palm under coconut + vegetable intercropping system followed by coconut + pineapple (107 nuts/palm), coconut + fodder grass (102 nuts/palm) and mono cropping (98 nuts/palm) during 2014-15. The economic advantage of the system under coastal sandy soil is that all the cropping systems realized higher net returns as compared to mono crop. The net returns ranged from Rs. 0.46 lakh/ha/year in case of coconut mono crop to Rs. 1.13 lakhs/ha/ year in case of coconut + pineapple intercropping system. ■

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Coconut – cultural significance

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“Plant coconut trees, they feed you and your children”

The coconut palm is one of nature's wonder. In India, it is appropriately eulogized as 'Kalpavriksha' (a mythological tree supposed to grant all desires – “the tree that provides all the necessities of life”). It is “Pokok seribu guna” (the tree of a thousand uses) to Malay, and “Tree of life” or “Tree of heaven” for a Filipino, “Tree of abundance” or “Three generations tree” to an Indonesian. The very names are reflective of its uses and essentiality in everyday life of people in the tropics. Each and every part of the palm is useful in one way or another and not even an inch of the tree goes waste. The coconut palm is intertwined with life itself, from the food they eat to the beverages they drink and derive almost everything necessary to sustain the life. All the daily needs such as household utensils, baskets, cooking oil, furniture and cosmetics can be made from coconut palm.

Origin and history

The origin of coconut palm is the subject of controversy. Indian mythology credits the creation of palm with its crown of leafy fronds to the sage Vishwamitra, to prop up his friend King Trishanku when the latter was literally thrown out of heaven by Indra for his misdeeds. In Vadakurungaduthurai, Lord Kulavanangeesar is believed to have taken the form of a coconut tree to help quench the thirst of a pregnant woman. In Kerala, Goddess Bhagavati is believed to be the soul of the coconut tree. One of the Goddess's common epithets is Kurumba which means 'tender coconut'. Folktales of all other areas narrate that coconut originated from head of a dead man or from a dead eel. The history of coconuts goes back a long way. It is a journey that began in ancient times. One of the places where the coconut palm was first written about was in



India over 2000 years ago. Early sanskrit writings from the 4th century BC as well as Tamil literature dating from the 1st to 4th century AD mention this particular palm species. Coconuts were featured throughout the Hindu epic stories of the Ramayana and Mahabharatha. The southern coast of India became familiar with coconut long before the country's northern region and later into aryan rituals. The coconut has a prominent role in Indian ritual and mythology (<http://www.hawaiicoconuts.com/coconut-folklore-history/>).

Etymology

The Sanskrit term narikela for coconut is believed to be an aboriginal word, derived from two words of South Asian origin, niyor for oil and kolai for nut (Iyengar, 1913; Achaya, 1998). The Tamil word 'nai' is for a semisolid greasy fat and appears to be derived from words like ngai and niu used for coconut oil in Polynesia and Nicobar islands (Chattopadhyaya, 1970). The root for names for coconut in Tamil, Telugu, Malayalam, and Kannada languages is ten. Coconut known as tengai (literally honey fruit) in Tamil and as "Nariyal" in Hindi (fruit containing water) from the root word "nari" meaning "water". In Sri Lanka names for coconut are derived from ten again directing towards south. Therefore, one has to look for the islands of South Pacific – Malaysia and Polynesia. The local names for coconut in Polynesia, Melanesia (niu), the Philippines, and Guam (niyog) are derived from the Malay word nyiur or nyior. This fact is often cited as evidence that the species originated in the Malay-Indonesian region. Amarkosha (500–800 AD) records synonyms of coconut and refers as nariker, narikela, and langalin.

Cultural significance

Symbolism

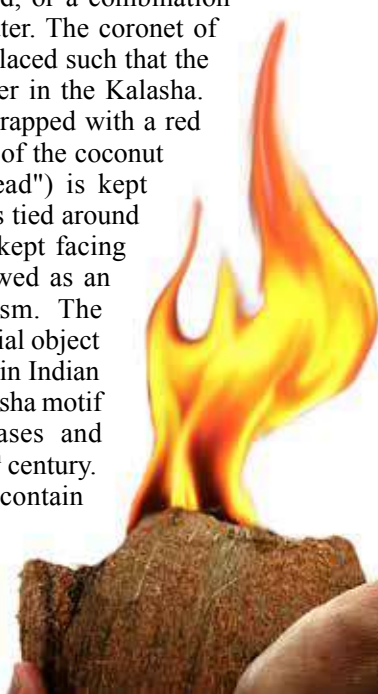
Coconuts have symbolic importance within Hinduism. In Indian culture "Nariyal" or copra is a symbol of good luck and prosperity. All religious functions and rituals start with the offering of coconut since it is regarded

as the symbolic Ganesh, the deity who helps in the successful completion of any work undertaken. Every auspicious work begins with the breaking of coconut and the offering of nariyal is a traditional ritual. For success and prosperity at all occasions, the launch is done with the breaking of a sanctified coconut.

The coconut's rough exterior fibers look like hairs, and its round shape and three eyes resemble a face. For this reason the coconut has been used to represent the three eyes of the Hindu god Shiva. One interpretation is that the three round dots found on the base of coconut represent the Trimurti (Brahma, Vishnu and Mahesh), the three main forms of God. Another understanding is that these dots symbolize the belief that, in effect, human beings have three eyes, two physical eyes and a third inner, invisible eye, which can distinguish right from wrong and which acts as a conscience. It is said that coconut can help to fulfill all the desires of the person worshipping it and some consider the three marks on coconut as the marks of Brahma, Vishnu and Mahesh. The coconut can also symbolize a proud heart as it has a rough exterior but the fruit within is sweet and tender.

Puja

In the Hindu religion, puja involves honoring and connecting with a deity or divine spirit. During puja, Hindus make an offering to the deity and receive a blessing in return. Both the fruit and leaves of a coconut are used during puja. The coconut fruit is used to represent a divine consciousness and is often displayed with its leaves in a pot called a kalasha. A kalasha, also spelled kalash or kalasa is a metal (brass, copper, silver or gold) pot with a large base and small mouth, large enough to hold a coconut. Sometimes "Kalasha" also refers to such a pot filled with water and topped with a coronet of mango leaves and a coconut. This combination is often used in Hindu rites and depicted in Hindu iconography. Sometimes the Kalasha is filled with coins, grain, gems, gold, or a combination of these items instead of water. The coronet of 5, 7, or 11 mango leaves is placed such that the tips of the leaves touch water in the Kalasha. The coconut is sometimes wrapped with a red cloth and red thread; the top of the coconut (called Shira – literally "head") is kept uncovered. A sacred thread is tied around the metal pot. The Shira is kept facing the sky. The Kalasha is viewed as an auspicious object in Jainism. The Kalasha is used as a ceremonial object as well as a decorative motif in Indian art and architecture. The Kalasha motif was used in decorating bases and capitals of pillars from the 5th century. The Kalasha is believed to contain





amrita, the elixir of life, and thus is viewed as a symbol of abundance, wisdom and immortality. The Kalasha is often seen in Hindu iconography as an attribute, in the hands of Hindu deities like the creator god Brahma, the destroyer god Shiva as a teacher, and the goddess of prosperity Lakshmi. The entire arrangement is called Purna-Kalasha. Purna-Kumbha or Purna-ghata. The Purna-Kalasha is considered a symbol of abundance and "source of life" in the Vedas. Each of these names literally means "full or complete vessel" when the pot is referred to as the Kalasha (to avoid confusion, this article will refer to the pot as Kalasha and the entire arrangement as Purna-Kalasha).

The Purna-Kalasha is believed to be a symbol of auspiciousness embodying either Ganesha, remover of obstacles, or his mother Gauri, the goddess of household bounty or Lakshmi. The Purna-Kalasha is worshipped in all Hindu festivities related to marriage and childbirth, as a mother goddess or Devi. The coconut, a cash crop, represents prosperity and power. The water in the pot represents the life-giving ability of Nature. In this form, the Purna-Kalasha symbolizes the Goddess as the manifestation of mother earth with her water, minerals, and vegetation. This method of Kalash pooja (worship) has come in for Vishnu in household functions to. The Purna-Kalasha is worshipped at Hindu ceremonies like Griha Pravesha (house warming), child naming, havan (fire-sacrifice), Vaastu dosha rectification, and daily worship. A kalash is placed with due rituals on all important occasions. It is placed near the entrance as a sign of welcome. It is also used in a traditional manner while receiving holy personages. Components of the coconut palm are incorporated into a variety of Hindu rituals. Some Indian coastal villages that make a living primarily through the fishing industry present offerings of coconuts to ensure calm, bountiful seas. In the state of Kerala, the largest producer of coconuts in India, coconut flowers are planted in rice bowls and displayed during wedding ceremonies. Hindus break coconuts when blessing a new home or business venture.

Aadi Festival

During Aadi festival, celebrated mid-July to mid-August, Hindus worship the goddess Amman in which coconuts are broken over the heads of the faithful. The ritual is representative of fulfilling a personal commitment or gratitude to the goddess for her blessings.

Coconut Presume to be akin to Human Ego

One of the most common concept associated with coconut is that it represents the ego of a person. This is exactly why a person is made to break a coconut. This ensures that he or she surrenders ego to the deities before they begin the puja or the prayer. Coconut is the only fruit that looks like the head of a human being. The juice inside coconut is considered to be the desire. The traditions say that unless one gets rid of desires and ego one cannot really pray to the deities with devotion.

Selfless bestower

Coconut is considered to be a tree that gives everything. While the leaves are used for thatching and covering enclosures, the kernel is a healthy food. Coconut water is unpolluted water that has excellent re-hydrating properties that can be consumed even during serious illness. As a thirst quencher and as a natural antibiotic can be applied on bruises and burns. The kernel can also be used as a fuel. Coconut is a symbol of selfless service to the almighty. Each and every part of coconut is of use to mankind. Nurturing a coconut tree does not require much effort. It can grow all on its own and serve the mankind in many ways.

Conclusion

Coconut is considered as one of the ten most useful trees in the world, and one among the five Devavrikshas (God's trees) known in India, providing food for millions, especially in the tropics. The multiplicity and versatility of uses of coconut tree can be best judged by an Indonesian saying: "There are as many uses for the coconut as there are days in the year." As the coconut tree is named "kalpavriksha" it seems to be like a god given gift in relation to its purity and its primordial uses to the mankind. ■

Participatory approaches for enhancing technology utilization in coconut

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Introduction

India is one of the major producers of coconut in the world and about 12 million people are dependent on coconut farming and its allied activities. India produced 20,439 million nuts in the year 2015 from an area of 1.97 million ha (Coconut Development Board, 2015). In India, the palm is cultivated in 18 states and 3 Union Territories and supports the livelihood of over twelve million people. It is of greater importance in the agrarian economy of the four southern states of Kerala, Tamil Nadu, Karnataka and Andhra Pradesh, which account for 90% of the coconut cultivation in India. In the recent past, coconut sector suffers from price fluctuations, pests and diseases, moisture stress, lack of value addition etc. Hence, technological innovations and diffusion of new technologies are the key drivers to enhance the productivity and profitability of coconut farming. Through the systematic research conducted at Central Plantation Crops Research Institute and State Agricultural Universities (SAUs) during the last few decades, a substantial number of viable technologies related to crop improvement, production, protection and pre & post harvest processing have been evolved for enhancing coconut productivity and profitability.

Various programmes are implemented by research and development agencies on a regular basis as part of the efforts to disseminate the research results among the coconut cultivators.

In spite of the efforts made by coconut research and development/extension agencies farmers are not able to exploit the production potential from the improved technologies to the desirable extent. Studies have found that the extent of adoption of technologies recommended for higher yield and income from coconut farming is comparatively low due to various constraints including socio-economic, technological, management or infrastructure. Low and fluctuating price of coconut is the most important problem faced by coconut growers. Lack of sufficient labour for climbing palms and high wage rate also create much problem to farmers. Incidence of pests and diseases is another important problem experienced by coconut farmers. Predominance of senile and unproductive palms, high cost of inputs, lack of availability of quality planting materials, low availability and utilization of organic manure due to reduced adoption of livestock integrated farming, lack of irrigation/drainage facilities etc are also often reported as constraints in adopting the recommended practices

of coconut cultivation. Majority of the coconut growers belong to small and marginal holding categories and the uneconomic holding size limits the adoption of recommended technologies for higher productivity and income from coconut farming.

The low level of technology utilization at farmers' fields' demands for innovative extension approaches suitable to the heterogeneous farming situations in coconut cultivation. Hence, participatory extension approaches have been attempted through action research with farmers' participation by CPCRI for enhancing technology utilization by coconut farmers.

Technologies on coconut

Technologies are generated mainly at the research institutes which include Central Plantation Crops Research Institute (CPCRI) under the Indian Council of Agricultural Research (ICAR) and the State Agricultural/Horticultural Universities. Central Plantation Crops Research Institute (CPCRI) is the pioneering research organization in India conducting research on different aspects of coconut cultivation. CPCRI also coordinates research on coconut within the country and execute the research programmes under the All India Coordinated Research Project on Palms. Technologies for enhancing productivity and profitability from coconut farming can be broadly categorized as follows.

- Improved varieties and hybrids suitable for different agro climatic regions with specific traits and high yielding potential
- Agronomic practices viz., planting, spacing, irrigation, mulching etc for optimum use of resources
- Cropping system/farming system models suitable for different agro climatic regions for enhancing resource use efficiency
- Organic farming technologies/ organic recycling for sustainable production of coconut
- Soil and water conservation measures
- Integrated Pest and disease management
- Pre and post harvest gadgets and machineries
- Value added products

It has been demonstrated that an increase in yield by four folds can be achieved by adopting proper cultivation practices for coconut as compared to the poor managed palms. Various organizations involved in the research and development of coconut are streamlining their activities to enable the farmers to make use of the technologies for enhancing the production and productivity.

Technology utilization in coconut

The process of research could be considered as successful only when the results reach the ultimate user. A substantial quantum of technologies has been evolved at research stations for the improvement of coconut. But the extent of adoption of these technologies at the

cultivators' level is not that satisfactory. Based on the review of studies, the adoption of technologies in the farmers fields could be classified as follows (Thamban, 2010).

Table 1 : Technologies on coconut	Adoption (%)
Hybrids, fertilizer application in split doses, green manure, irrigation, systematic intercropping/mixed cropping, plant protection measures, application of lime, biological control of pests, post harvest technologies.	< 25
Regular planting with adequate spacing, application of organic manures, application of salt, moisture conservation techniques, magnesium sulphate application, Eriophyid mite control.	26-50
Planting of own seedlings, selection of seedlings, mulching	51-75
Local WCT variety, planting method, rainfed farming, mother palm selection, basin opening.	>75

Need for participatory extension approaches

Technologies on coconut is mainly disseminated through different extension approaches by ICAR-CPCRI, AICRP (Palms) centres, Coconut Development Board, State agricultural/horticultural universities, State department of agriculture/horticulture, Krishi Vigyan Kendras(KVKs), NGOs, farmers' organizations, mass media etc. Front line extension activities are organized by ICAR-CPCRI and SAUs. On farm testing, front line demonstration, training and extension activities are carried out by KVKs. Mainstream extension programmes in coconut are mostly organized by Coconut Development Board (CDB), State Department of Agriculture/Horticulture and farmers organizations.

Participatory extension approaches are gaining importance due to various reasons and these approaches are based on effective participation of rural communities. The focus is to promote greater involvement of farmers in planning and implementing technologies. Farmers are encouraged to take initiative and work with extension staff on equal terms, for testing and implementing technologies. Capacity building, social mobilization, experiential learning and empowerment are major elements in this approach.

The comparison of conventional extension with participatory extension is given in Table 1 for better understanding of the two approaches (Scoones & Thompson 1994). The focus of extension changes from teaching to learning; from hierarchical, top-down to participatory bottom-up approaches; from centralized to decentralized decision making.

Table 1. Conventional extension versus participatory extension		
Feature	Conventional	Participatory
Main objective	Transfer of technology	Empowerment of farmers
Analysis of needs and priorities set by	Outsiders (extension agents, researchers)	Farmers facilitated by outsiders
Primary R&D location	Research station	
	Farmers' fields and conditions	
Menu of technologies	Fixed (blanket recommendations)	Baskets of options (flexible recommendations)
Dissemination process	Linear transfer of precepts, messages and technological packages.	Dynamic process based on joint analysis and farmers' choices
Farmers behaviour	Taught about the message: adopt or reject	Use methods, choose from basket and experiment
Outsiders desired outcome	Widespread adoption	Wider choice for farmers and enhanced adaptability
Main mode of diffusion	Extension workers to farmers	Farmer to farmer
Role of extension agent	Provider of information, technical supervisor, teacher	Facilitator, catalyst, advisor

Extension approaches for enhancing technology utilization in coconut need to consider the following factors for successful implementation with the active participation of the stakeholders.

- Long gestation period and perennial nature
- Size of the holdings
- Agro climatic conditions
- Availability of know how
- Availability of natural resources
- Availability of planting materials/inputs
- Cropping/ farming system
- Pests and diseases
- Government schemes/ projects/subsidies
- Development/Policy initiatives both at national and international levels
- Availability of skilled labour
- Gender involvement
- Socio economic conditions
- Market access
- Demand/price of the produce

Refinement of extension approaches pave way for reaching out to the relevant stakeholders more efficiently

and effectively. Farming is not an isolated activity by any means. It has the foundations in culture, heritage, experiences, tacit knowledge, knowledge innovations, innovation systems and social process. Hence, participatory extension approaches are the need of the hour for enhancing technology utilization at the grass root level for doubling income of the farmers and its role in technology innovation system.

In view of the above discussion, participatory extension approaches have been attempted through action research with farmers' participation by CPCRI for enhancing technology utilization by farmers which are described below in brief.

1. Community Based Organizations (CBOs) for sustainable income enhancement

i. Project: Developing sustainable coconut based income generating technologies sponsored by International Plant Genetic Resources Institute (IPGRI)

Objectives: To augment the production and productivity of small and marginal holdings and Management of farmers' resources to reduce cost of cultivation and to increase productivity through integration of technologies

Interventions: Implemented in two selected coconut communities at Pallikkara in West Coast region and Ariyankuppam in East Coast region. The three-pronged strategy routed through CBOs included i) growing suitable inter/mixed crops in coconut gardens and integrating animal husbandry and other subsidiary enterprises ii) cultivating high yielding cultivars to enhance the yield and income and iii) promote the diversification of coconut products

Impact: Sustainable income, employment generation and conservation of natural resources.

ii. Project: Overcoming Poverty in Coconut Growing Communities: Coconut Genetic Resources for Sustaining Livelihoods in India sponsored by IFAD

Objectives: To improve the food and nutritional security and to enhance the income from coconut cultivation

Interventions: Participatory planning and implementation of intercropping and off-farm activities in small and marginal coconut homesteads in Pathiyoor, Thodiyoor and Devikulangara panchayats through registered Community Based Organizations (CBOs) along with nutrition education

Impact: Tremendous increase in income from intercrops, livestock and household level processing and the total annual income per homestead enhanced from Rs.25,617 to Rs.59,017. Improvement in productivity and efficiency of coconut-based farming systems was attained through intercropping of cash, food and nutritional security crops and genetic resource management.



Demonstration on coconut based cropping/farming system

iii. Project: Value chain in coconut sponsored by NAIP

Objectives: To integrate production and processing technologies in coconut holdings for higher income

Interventions: Technological interventions on soil and water conservation, soil health management, integrated nutrient management, inter/mixed cropping, integrated pest and disease management were implemented in 10 CBOs comprising of 534 farmers in clusters of 25 ha each. Four women SHGs were facilitated to take up microenterprises on production and marketing of coconut value added products.

Impact: Enhancement of farm income and livelihood security. Approach is being scaled up by Coconut Development Board, State Department of Agriculture and Local Self Governments

iv. Project: Community based bio-resource management for sustaining production and livelihood security under coconut based farming systems

Objective: Management of bio resources for sustaining the productivity and livelihood security

Interventions: Awareness programmes, training-cum-demonstrations, small group discussions, farmer field schools and household level trainings on bioresource management and integrated nutrient management were organized. One organic manure production unit with 20 women members and Community bioprimer coconut nursery were established.

Impact: Improvement (89.7%) in farm income from coconut and other intercrops

2. Participatory technology assessment/transfer

i. Project: Technology Assessment and Refinement through Institution-Village Linkage Programme (IVLP).

Objective: To improve participation of farmers in research and extension

Interventions: Implemented in three villages, viz., Pady, Edneer and Nekraje of Kasaragod with coconut as one of the important crops in the production system of the villages. Agro-ecosystem analysis, diagnosing and prioritizing the problems, identification of technological

interventions, development of action plans, detailed socio-economic evaluation including farmers' reactions and perceptions about the interventions were done using various PRA tools and techniques.

Impact: Increased effectiveness of participatory approach in the performance assessment of various technologies related to high yielding varieties, intercropping, nutrient management and crop protection in coconut.

ii. Project: Management of coconut root (wilt) disease in coconut

Objective: For technology assessment in coconut root (wilt) diseased areas

Interventions: Farm families of manageable contiguous area (50-100 ha) were the participating farmers and participatory rural appraisal tools were used. Multidisciplinary team of scientists, extension officials, farmer representatives, local village representatives, women and youth were involved.

Impact: Awareness, knowledge, attitude and adoption of farmers towards the technology for the integrated root (wilt) disease management were improved by 40-85 per cent

iii. Project: Evolving Climate-Smart Adaptations in the management of coconut based farming systems under coastal sandy soil conditions of South Kerala

Objectives: Identification of ideal crops and income enhancement from coconut and intercrops

Interventions: Modified method of husk burial for pine apple, shifting of planting time, planting of 4-5 months old suckers and earthing up with silt and coconut husk, green manure, coir pith compost and husk for banana, planting of short duration varieties and shifting of planting time for tuber crops were done.

Impact: Employment generation and enhancement of income from coconut and intercrops

3. Farmer field schools (FFS)

Project: FFS for the management of rhinoceros beetle in coconut

Objective: To enhance the knowledge of the farmers for managing the pest

Interventions: Formation of FFS in 15 locations of Aleppy district and regular meetings, field visits, focus group discussions etc. for the identification and management of the pest.

Impact: Awareness and knowledge of farmers were improved by 100 per cent over pre FFS level.

4. Self Help Groups

Project: Developing sustainable coconut based income generating technologies in poor rural communities in India' sponsored by IPGRI

Objective: To develop women entrepreneurs through SHGs by entrepreneurship development programme

Interventions: Product diversification in coconut,



R- E-F interface at Manjeswar, Kasaragod



Honouring winners in Quiz competition

production of quality copra using copra dryers, coconut kernel based food products, preparation of coconut candies, production of Snow Ball Tender Nut, production of coconut chips, Oyster mushroom cultivation on coconut wastes and production of vermicompost using coconut leaves etc were included.

Impact: Improvement in income of resource-poor coconut farmers and socio-economically disadvantaged rural women

5. Research-extension-farmer interface

Technology dissemination process will be accelerated if concerted efforts are made by the different agencies having proper co-ordination among them. In this approach, researchers, extension personnel and farmers are brought together on a common platform to streamline the activities for the sustainable development of coconut (Rajagopal et al., 2004). In this context, ICAR- CPCRI had organized research-farmer-extension interface programmes on coconut in 12 districts of Kerala during 2002-03 and 13 districts of Karnataka during 2013 to create awareness about the technological options and developmental opportunities available to address the problems and enhance the profitability of farming. These programmes were organized as a collaborative effort with SAHUs, KVKs and Department of Horticulture. Thematic sessions related to crop improvement, crop production, crop protection and value addition were covered in the interface programmes, in which scientists from CPCRI, SAUs/SHUs and KVKs, extension personnel from Department of Horticulture and farmers had participated. Innovative quiz programmes for the farmers were also organized in collaboration with Department of Agriculture and All India Radio, Kannur.

Impact: Useful for decentralized planning for implementing various schemes at the grass root level. Improvement in adoption of technologies ultimately leading to coconut growers' own benefit.

6. Area wide community extension approach (AWCA)

Project: Area wide community extension approach (AWCA) for management of coconut pests

Objective: To manage coconut pest through community extension for sustainable production of coconut

Interventions: Strengthened linkages with peoples' representatives, farmer organizations, farmer leaders, co-operative societies of farmers and co-ordination with various extension departments and research institutions. Capacity building of women farmer groups as master trainers and farm level producers of Green Muscardine Fungus (GMF) and targeting the 'potential and critical adopters' of the bio control technology against rhinoceros beetle management.

Impact: More than 90 per cent of the potential adopters were reached within two months and post intervention data indicated 75.8% reduction of fresh pest infestation

7. Cyber extension

CPCRI has been implementing various cyber extension activities in collaboration with other agencies on a participatory mode as part of strengthening the technology transfer programmes for coconut.

Videoconferencing: A video conferencing system through ISDN was installed to facilitate interaction between various stakeholders for enhancing technology utilization in coconut. Effective linkages are established with various agencies such as ICAR institutes, Coconut Development Board, State Department of Agriculture/ Horticulture, State IT Mission, NGOs like MSSRF, people's representatives and farmers' organizations for the effective conduct of the interactive videoconferencing programmes.

E kalpa: An Android based mobile Application 'e-kalpa' developed for reaching the farming communities in multilingual formats. The Mobile App consists of Knowledge base (coconut), farmers' field problems/ issue management system (multi mode farm reporting of field problems and receiving advisories), online farmers diary, Synchronized farming (for new farmers and FLD/ PTD farmers) and Notifications (Meetings/ trainings/ announcements). The App is widely used by many farmers since its launching in October 2016. An e Plantation Survey App was also developed for accurate GPS tagged data collection for research projects and extension activities. The Survey app could be used for any survey enabling paperless, time saving and real time data documentation in any of the csv formats for analysis without any manual data entry.

8. Harvesting wisdom of coconut growers

Progressive farmers in various parts of the country made significant achievements in coconut farming by adoption of scientific cultivation. Such farmers have amply demonstrated the impact of utilizing scientific technologies for enhancing productivity and income from coconut farming. Further, many of them have evolved innovative farming practices appropriate to the agro-ecological situation for sustainable coconut production. Coconut Development Board, State Agriculture/Horticulture Departments and other agencies including Local Self Governments have been implementing schemes to promote such coconut farmers by giving awards and recognitions for their achievements. Hence, efforts were made by the institute for documenting experiences of innovative coconut growers across major coconut growing tracts viz., Kerala, Tamil Nadu, Andhra Pradesh, Karnataka, Goa, Maharashtra, Gujarat, Odisha, West Bengal, Assam, Andaman & Nicobar Islands and Lakshadweep and Minicoy Islands in 2016 (Thamban et al., 2016a). Selection of farmers was made in consultation with the concerned State Agriculture/Horticulture Departments, Coconut Development Board, All India Co-ordinated Research Project (Palms) Centres functioning under CPCRI and Krishi Vigyan Kendras. A team of scientists from ICAR-CPCRI visited the identified farmers' gardens and documented their successful experiences on a participatory mode. Socio-personal profile characteristics, details of the coconut garden, extent of adoption of improved farming practices including improved varieties and quality planting materials, effective water management and irrigation techniques, integrated nutrient management, multiple cropping and integrated farming, integrated pest and disease management, value addition through product diversification, innovative farming practices evolved, economics of coconut farming, marketing practices, efforts made for disseminating improved coconut production technologies among other farmers and linkages with research, development and extension institutions were documented as part of the programme. The successful experiences of innovative coconut growers were documented, analyzed and honored for motivating farmers for adoption of improved technologies.

9. Friends of coconut Tree (FoCT)

Coconut Development Board has initiated an innovative training programme viz., 'Friends of Coconut Trees (FoCT)' to develop a professional group of youth for harvesting and plant protection operations in coconut. The training targeted the group of unemployed youth in developing technical skills, entrepreneurship capacity, leadership qualities and communication skills to address the needs of the coconut growers. KVKs functioning



Video conferencing system at CPCRI

under CPCRI at Kasaragod and Kayamkulam organize the training programme on participatory mode to benefit the rural youth. Trained youth including farm women are getting employment by doing hybridization, neera tapping, plant protection and harvesting operations.

10. Farmers participatory research cum demonstration

CPCRI has been organizing farmers' participatory research cum demonstrations in farmers' fields on different coconut cultivation technologies such as coconut based farming systems, soil and water conservation, management of root (wilt) affected coconut gardens, cocoa as a profitable intercrop in coconut gardens etc in different states of the country. Such demonstration programmes have proved to be effective in convincing the farmers about the technical feasibility and economic viability of the technologies.

All the participatory approaches discussed above were successfully implemented on project mode by following the principles of participatory extension. Many of the approaches implemented by CPCRI are being upscaled by Coconut Development Board, State Department of Agriculture, Farmers' organizations etc. for the benefit of farming community. Advantages and disadvantages of participatory approaches as perceived by stakeholders are given below.

Advantages

- Consultation and access to information for the local people about the intentions of outsiders
- Freedom of choice for local people to engage in a process of technology transfer.
- Empowerment through redistribution of power on the basis of equity and compatibility.
- Mutual trust and respect
- Distribution of benefits to partners equally.
- Adaptability and flexibility of outside institutions to changing and sometimes unforeseen circumstances.
- Strengthens the link between indigenous and scientific knowledge
- Builds human capacity for self reliance
- Interactive and participatory in nature
- Farm family approach with gender concerns



Honoring Innovative farmers at CPCRI



Demonstration on soil and water conservation measures



Training for Friends of Coconut Trees (FoCTs)

- Inclusive of weaker sections
- Area wide interventions
- Integration of extension techniques and methods
- Focused technology interventions for improving the impact

- Utilizing the digital literacy to reach the unreached

Disadvantages

- Demands patience
- Time consuming

Conclusion

Coconut research institutes have developed a number of technologies by the use of which remarkable improvements in the coconut productivity levels have been achieved. However, the wide gap that exists between the recommended practices and their actual level of adoption in various holdings indicates the presence of major barriers in improving the productivity levels. In order to break these barriers, the development efforts

being implemented by various research and development organizations are needed to be strengthened which should form one of the primary tasks towards achieving the targets of improving the coconut productivity and profitability levels. Effective linkage is to be established among different research, extension agencies and coconut farmers through well co-ordinated participatory research/extension.

It is strongly believed that participatory approaches are the need of the hour to make the farming profitable and sustainable. But at the same time, participatory approaches are not a substitute for conventional extension. It is a complementary process which does link the power and capacities of researchers, extension workers and development departments to the priorities and capacities of farming communities, in order to develop productive and sustainable farming systems. ■

References

- CDB. 2015. Coconut Development Board, Kochi, India. coconutboard.nic.in. , Rajagopal, V., Arulraj, S. and Thamban, C. 2004. Research-Extension interface for transfer of technology on coconut. CPCRI, Kasaragod. p 33. , Scoones, I. and Thompson. J. 1994. Beyond farmer first. Rural people's knowledge, agricultural research and extension practice. London: Intermediate Technology Publications (IIED)., Thamban, C. 2010. Extension approaches to enhance technology utilization and income generation in coconut farming. In. Proceedings of International Conference on Improving Productivity and Profitability in Coconut Farming (Eds. George V. Thomas V Krishna Kumar and B. Augustine Jerard), October 25-28, 2010, CPCRI Kasaragod. 443-456 pp. , Thamban, C., Jaganathan, D, Jayasekhar S, Chandran, K.P., and Chowdappa, P (Eds.) 2016a. Harvesting wisdom of coconut growers. ICAR-CPCRI, Kasaragod, Kerala, 204 p. , Thamban, C., Kalavathy, S., Anithakumari, P. and Jaganathan, D. 2016b. Reaching Coconut Farmers and other Stakeholders. In. CPCRI Centenary Souvenir; ICAR-CPCRI, Kasaragod, Kerala, pp 97-110



Convergence of the scientific community to expedite coconut tissue culture



The 1st International Symposium on Coconut Tissue Culture was organised by the Asian and Pacific Coconut Community in association with the Government of Thailand during 13-14 March 2017 in Bangkok, Thailand. A focused session on the progress in tissue culture was highly recommended by the FAO High Level Expert Consultation on Coconut Sector Development in 2013 and the 47th APCC COCOTECH Conference held in 2016 in Bali, Indonesia. The objective of the Symposium was to establish record of the stage of coconut tissue culture research in various coconut growing countries and explore the opportunities for collaboration between countries, institutions and individual scientific experts. With more than 50% of the coconut plantations in the world being categorised as senile and unproductive, coconut growing countries are striving to meet the global demand for quality planting material and mass production of seedlings using biotechnology is the only solution.

The Symposium was attended by scientists and researchers working on coconut tissue culture across the globe, policy makers in Government and industry stakeholders who shared ideas and discussed and deliberated on possible collaborations to expedite the



development of rapid multiplication techniques for production of quality planting material in coconut. Around 75 participants from 15 countries participated apart from representatives from international organisations like CIRAD and COGENT. Government of India was represented by Shri. Saradindu Das, chief Coconut Development Officer of Coconut Development Board.

The inaugural session of the Symposium was graced by Dr. Surmsuk Salakpetch, Deputy Director General,



Department of Agriculture, Ministry of Agriculture and Cooperatives, Government of Thailand and the National Liaison Officer of APCC. She welcomed the participants to the Symposium and appreciated the efforts of APCC for addressing the issue of large scale production of planting material. She expressed hope that the Symposium would pave the way for productive discussions and networking. Mr. Uron N. Salum, Executive Director, APCC, in his opening statement explained the background of the Symposium and stressed on the need for the stakeholders to collaborate to address the need for good quality planting material. This was followed by a presentation by Dr. Ponciano Batugal, Chairman of the APCC Technical Working Group and former COGENT Coordinator on the need for collaboration in coconut tissue culture. He explained the objectives and format of the Symposium and the need for the formation of an APCC International Advisory Committee for Coconut Tissue Culture.

The First Session of the Symposium included keynote addresses on the importance of tissue culture for the coconut sector which was chaired by Dr. Ponciano Batugal. Dr. Alain Rival, CIRAD Resident Regional Director for South East Asian Island Countries, in his keynote address on the topic “Coconut Biotechnologies need International Cooperation” explained the need for collaboration and the factors hampering fluent networking. He gave a brief profile of CIRAD and its mandate on agricultural research including the partnership platforms for research and training. He further briefed on the program Sustainable Agricultural Systems in South East Asia (SALSA).

Dr. Steve Adkins, Professor in Plant Physiology at the University of Queensland, Australia presented his keynote address on the potential of tissue culture techniques for the improvement of coconut. He explained the advances in embryo culture, cryopreservation and somatic embryogenesis and stressed on the need for utilising them to solve the issues with coconut germplasm conservation and multiplication.



Dr. Carlos Salin Oropeza, Researcher from Centre de Investigac’ion Cientí’fica de Yucat’an(CICY), Mexico presented his keynote paper on the progress of tissue culture in Mexico. He elaborated on the coconut in vitro studies undertaken in Mexico which included development of micropropagation protocols, scaling up of micropropagation, maintenance of embryogenic lines and germplasm conservation and germplasm exchange. He further explained the system developed by CICY for massive micropropagation of coconut based on plumule or rachilla explants and called for collaborative efforts in research.

The Second Session focussed on an updation of the status of coconut tissue culture in each country. The country representatives presented the country papers on the progress with coconut tissue culture and the session was chaired by Dr. Steve Adkins.

In the first part of Session Two, Dr. Edna A. Anit, Supervising Science Research Specialist/Assistant Director, Department of Science and Technology – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) represented the Philippines and gave an update on the Coconut Somatic Embryogenesis



technology(CSet) undertaken by the Philippine Coconut Authority(PCA) and the need for improvements in the technology and development of a working protocol.

Dr. Vijitha Vidhanaarachchi, Head, Tissue Culture Division, Coconut Research Institute, Sri Lanka presented the progress in coconut tissue culture in Sri Lanka. She briefed on the research on clonal propagation, embryo culture and anther culture undertaken by the Institute. She also explained the cryopreservation work done. This was followed by the paper from India presented by Dr. Anitha Karun, Principal Scientist and Head, Division of Crop Improvement, Indian Council of Agricultural Research – Central Plantation Crops Research Institute (ICAR-CPCRI), Kerala, India. She explained the various types of explants tried which included zygotic embryo, embryonic meristem, plumular portion, inflorescence, ovary and anther. She briefed on the genotypic variation in tissue culture and the molecular aspects of smatic embryogenesis. She also presented the work on use of new chemicals and electric current and the future thrust areas. Dr. Meity A. Tulalo, Scientist at the Indonesian Palm Crops Research Institute, Manado presented the progress on coconut tissue culture in Indonesia. The embyro culture techniques were predominantly used in multiplication of Kopyor coconut in Indonesia. She also explained the technique of embryo incision done to produce double seedlings.

The second part of Session Two was chaired by Dr. Alain Rival, CIRAD Resident Regional Director for South East Asian Island Countries. Ms. Parinda Hrunheem, Agricultural research Officer from the Chumphon Horticultural Research Centre presented the country paper on the progress of coconut tissue culture in Thailand. Coconut Embryo culture is predominantly undertaken in Thailand for the propagation of Makapuno. National Centre for Genetic Engineering and Biotechnology(BIOTEC) is one centre of the National Science and Technology Development Agency (NSTDA) who have successfully developed oilpalm tissue culture via somatic embryogenesis and it is proposed to use the same model for coconut, especially aromatic coconut in Thailand. Young leaf and immature inflorescence explants are used in coconut tissue culture. Mrs. Ngo Thi Kieu Duong, Leader Technical Advisor, Anh Dao Science Technology Agriculture Joint Stock Company, Ho Chi Minh City presented the progress on coconut

tissue culture in Vietnam. Embryo culture in “dua sap” is being undertaken. Dr. Najya Muhammed, Senior Lecturer in Pwani University, Kenya presented the country paper on the progres of coconut tissue culture in Kenya. Coconut embryo culture has been attempted to produce quality planting material. Challenges in acclimatisation of seedlings is to be addressed. Dr. Sisunandar presented his paper on the research progress on Kopyor Tissue culture by the University of Purwakerto in Indonesia. He explained embryo culture, embryo incision protocol and somatic embryogenesis in Kopyor coconut. Genetic diversity testing and seed garden collection of Kopyor is also undertaken.

The Third Session of the Symposium on Group Discussions on the way forward for coconut tissue culture was chaired by Mr. Keith Chapman, International Consultant and Industrial Crops Advisor, Inter Ag Consultant, Australia. The participants were divided into four groups based on their interest areas. Mr. Chapman briefed the participants on the four topics on which the groups had to deliberate and discuss: Embryo Culture, Cryopreservation, Somatic Embryogenesis and Genome Analysis. A template for the development of an International Strategic Action Plan on the four topics was provided which included development of a well defined Vision, Goals, Outcomes, Actions and Responsible Agencies for each of the topics. The groups were asked to define issues, problems and opportunities and from these define the desired Goals, Outcomes and Actions and Responsible Agencies /Groups for carrying out the Activities need to complete the Actions and realize the desired Outcomes. In addition each group was asked to provide their Vision for the overall First International Strategic Action Plan for Coconut Tissue Culture, and consider a proposed recommendation from APCC.

The draft strategic action plan was presented by the group leaders and findings were discussed and agreed in a follow-up Plenary session. Mr. Chapman finally summarised the outcomes of the Work group session. The Symposium went on to form an International Advisory Committee for Coconut Tissue Culture Forum which will be central to coordination and implementation of the First International Strategic Action Plan for Coconut Tissue Culture. ■

Report courtesy : Asian and Pacific Coconut Community

Awareness cum Farmers Training Programme

Coconut Development Board organized an awareness cum farmers training programme at DSP Farm of the Board, Hichachera, Sabroom, South Tripura on 18th February 2017. Shri. Jitendra Chaudhury Hon'ble Member of Parliament (Lok Sabha) inaugurated the programme and Shri. Pravat Chaudhury Hon'ble MLA, Manu Sabroom, South Tripura presided over.

Shri. Jitendra Chaudhury, Hon'ble Member of Parliament (Lok Sabha) in his inaugural address spoke on the importance of coconut cultivation and its utility for improving the income of farming community. He requested the Board to establish the farm in a mission mode so that the objective of establishment of the DSP Farm is fully achieved. He also requested the Board to occupy more unutilized area of the farm of the Agriculture Department for raising coconut nursery. He conveyed his gratitude to the State Government for handing over the land to CDB. He also requested Chairman, CDB to implement schemes of the Board for the benefit of the farming community of Tripura.

In his presidential address Shri Pravat Chaudhury spoke on the importance of establishment of a DSP Farm for coconut in Tripura. He assured all help and co-operation for the establishment of the farm.

Dr. A. K. Singh, Chairman, CDB in his keynote address spoke on the need for promoting scientific coconut cultivation in the state and requested to adopt different technologies for value addition in coconut so that, income of the farmers can be improved.

Dr. D.P. Sarkar, Director of Agriculture/Horticulture, Government of Tripura, called upon the farming community to take up coconut cultivation in the State and assured all help for the development of DSP Farm CDB at Hichachera.

Shri. C.K. Jamatia, IAS, District



Shri. Jitendra Chaudhury, Hon'ble Member of Parliament inaugurating the awareness programme.



Keynote address by Dr. A. K. Singh, Chairman, CDB

Magistrate, South Tripura spoke on the utility of coconut and its cultivation for the farming community and promised to render all help to CDB. Shri. Sathai Mog Member of TTAADC, Chairman, Rupaichari Block Advisory Committee, South Tripura also spoke during the occasion and requested the Board to extend all facilities to the farming community of the State. Good quality coconut seedlings need to be provided to the farmers for increasing the area and production of coconut in South Tripura as well as other parts of the State.

Dr. G.S.G. Ayyangar, IAS, Principal Secretary, Agriculture and Rural Development, Government of Tripura emphasized the need to promote coconut cultivation in the state for improving the livelihood of the weaker sections of the society.



Shri. Saradindu Das, Chief Coconut Development Officer, Coconut Development Board, Kochi, in his welcome address emphasized the importance of coconut cultivation in Tripura for the upliftment of the small and marginal farmers of the State. He further briefed the activities undertaken by DSP farm, Tripura since its inception in February 2016. Dr. A.K. Nandi Secretary, CDB, Kochi proposed vote of thanks.

A technical session was held as part of the programme wherein Shri. Lungar Obed, Director, CDB, Guwahati and Shri. Khokan Debnath, Dy. Director, CDB, Kolkata briefed on coconut cultivation and schemes of the Board for educating the farmers of the State. More than 500 farmers and officials attended the programme.

COCONUT DEVELOPMENT BOARD GOVERNMENT OF INDIA



Board's stall in Gramodaya Mela

Gramodaya Mela

Coconut Development Board, DSP Farm, Kondagaon participated in Gramodaya mela at Chitrakoot Madhya Pradesh during 24th to 27th February 2017. Shri Thawar Chand Gehlot, Union Minister of Social Justice and Empowerment inaugurated the programme in the presence of Shri Sudarshan Bhagat, Hon'ble Agriculture Minister, Madhya Pradesh.

CDB, DSP Farm, Kondagaon displayed different coconut by products, value added products and coconut handicraft items in the stall. Shri Giriraj Singh, Minister of Micro, Small and Medium enterprises Madhya Pradesh, Shri Vikash Pandey and Shri Kripal Singh Jaju Coordinators, Gramodaya Mela, Deendayal Research Institute Chitrakoot Madhya Pradesh visited Coconut Development Board stall.

Shri Narendra Singh Tomar, Union Minister for Mines, Steel, Labour and Employment and Shri Rajiv Pratap Rudy, Union Minister of State for Skill Development and Entrepreneurship (Independent Charge), Government of India participated in the valedictory function.

129th Meeting of CDB



The Board meeting in progress

The 129th Meeting of Coconut Development Board was held on 17th March 2017 at Bangalore under the Chairmanship of Dr. A.K. Singh, Chairman, Coconut Development Board. The meeting was attended by Shri P.C. Mohanan Master, Vice Chairman and other members of the Board; Shri C. P. Narayanan, MP (Rajya Sabha), Dr. P. Chowdappa, Director, CPCRI, Shri C. P. Radhakrishnan, Chairman, Coir Board, Dr. Raju Narayana Swamy IAS, Principal Secretary & Agriculture Production Commissioner, Government of Kerala, Shri P.R. Muraleedharan, Kerala, Shri S. Mohanraj, Tamilnadu, Shri M.R. Shankara Narayan Reddy, Karnataka, Smt. Daksha Rami, Gujarat, Dr. Biswanath Rath, Odisha and Kissan Shree Sanjeev Kumar Singh, Bihar. Shri Saradindu Das, Chief Coconut Development Officer and Dr. Anup Kumar Nandi, Secretary, Coconut Development Board also attended the meeting.

New Member of CDB



Kissan Shree Sanjeev Kumar Singh

Vill. P.O, Kala Dumra,
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Phone: 08969529999

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Krishi Unnathi Mela- 2017



Dr. A.K. Singh, Chairman, CDB in Board's stall in Krishi Unnathi Mela



Board's stall in Krishi Unnathi Mela



Coconut Development Board participated in Krishi Unnathi Mela 2017 held during 15-17 March 2017 at IARI Campus, New Delhi. The mela was jointly organized by ICAR and Ministry for Agriculture & Farmers Welfare. Hon'ble Minister of Agriculture and Farmers' Welfare, Shri. Radha Mohan Singh inaugurated the mela on 15th March, 2017. Institutes of ICAR across the country exhibited farmer friendly technologies, innovations and products. Besides, various government departments, NGOs, private sector and other stakeholders participated in the National Agricultural Fair. CDB participated in this mela with the theme "health, nutrition and wellness" by occupying 11 stalls. The theme pavilion of Ministry of Agriculture and Farmers Welfare took part in the exhibition with the Make in India theme.

CDB displayed various coconut products, posters and charts on CDB activities and achievements. Sale of agricultural inputs like farm equipments, quality planting materials, bio-fertilisers, agro-chemicals, innovative farmers' products and machineries including agriculture products from agriculture and horticulture sector were arranged in the Mela.

Digitization in agriculture, organic farming,

agribusiness models, precision farming, skill building and entrepreneurship development, live demonstrations on production technologies of crops, horticulture, integrated farming system, protected cultivation, farmers' visits to experimental fields at IARI, water use efficient technology, micro irrigation and sensor based irrigation system, recycling of waste water for agriculture, on-spot soil and water testing and recognition of innovative farmers were the main attractions of the mela. More than 50,000 farmers and other visitors participated in the mela.



Coconut Development Board's stall was awarded as one of the best stalls in the exhibition.

AAHAR 2017

Coconut Development Board, MDIC, Delhi participated in the 32nd edition of Aahar 2017 - the Food & Hospitality Fair from 7th to 11th March 2017 at Pragathi Maidan, New Delhi. Hon'ble Union Minister of Food Processing Industries, Smt. Harsimrat Kaur Badal inaugurated the Fair on 7th March 2017.

CDB participated in the fair and displayed various food, beverage and health products made from coconut. 18 coconut based manufacturers had their sales cum display counters in the Board's stall. The visitors were briefed on the nutritional values and other health benefits of coconut products.

M/s Yogic Foods, M/s Pure Tropics, M/s Keratech, M/s Palakkad CPC, M/s Vadakara CPC, M/s Kalpatheertha CPC, M/s Madhura Agro Process Pvt. Ltd. M/s Market Fed, M/s Surya Shoba, M/s Sakthi Coconut Products, M/s Green Nut international, M/s Sri Ram Coconut Products Ltd. M/s Habit Wellness Pvt. Ltd and M/s Agricol had their sales cum display counters in the Board's stall.

Visitors from various industries like Food processing, packing, machineries, refrigeration technologies and equipments received good response. The chefs present in the stalls of baking industry visited Board's stall and discussed about the use and qualities of desiccated coconut, coconut milk, milk powder, vinegar, etc. The international demand and export prospects of these products were also apprised to the visitors by Board officials.

The general public and traders were amused to know about the varied uses of different products of coconut. Many people were aware of the availability of packed tender coconut water in Delhi retail markets and was eager to know about the availability of coconut chips, virgin coconut oil and other value added coconut based consumer items. The recipes of various dishes and sweets using desiccated coconut, vinegar, milk, milk powder, etc. were distributed to the visitors along with publications of the Board.

A B2B was conducted on the 4th day of the Fair at



Board's stall in Aahar 2017



Dr. A.K. Singh, Chairman addressing the B2B meet.

NASC complex at PUSA. Dr. A K Singh Chairman CDB inaugurated the meet and interacted with the participants. He welcomed the new comers in the industry who were interested to take up coconut related trade and business. Many manufacturers presented their experiences, problems and suggestions before the meeting to solve the issues relating to manufacturing and marketing of coconut products.

More than 1050 Indian and 75 overseas participants from 22 countries showcased their products and services. Around 60,000 persons from India and abroad including business professionals and traders from the food and hospitality sector attended the fair.

The fair was organised by ITPO in association with the Ministry of Food Processing Industries, Government of India along with active support of the apex trade bodies which includes Agricultural & Processed Food Products Export Development Authority(APEDA), Association of Resource Companies for Hospitality Industry of India (ARCHII), Hotel and Restaurant Equipment Manufacturers Association of India (HOTREMAI), All India Food Processors Association (AIFPA), Food& Hospitality Support Association of India (FHSAI) and Forum of Indian Food Importers(FIFI).

Government of Andhra Pradesh permits neera extraction in the State

The Government of Andhra Pradesh has amended the Andhra Pradesh Excise Act, 1968 permitting the Coconut Producer Federations registered under Andhra Pradesh Societies Act, 2001 & affiliated to Coconut Producer Companies incorporated under Indian Companies Act, 1956 to extract Neera from coconut palms. The gazette notification in this effect published vide G.O.MS.No. 78 dated 20.02.2017

Madai Paramparik Mela

Coconut Development Board, DSP Farm, Kondagaon participated in Madai Paramparik Mela at Kondagaon from 7th to 12th March 2017. Shri Deelip Vashnikar IAS, Commissioner, Bastar Division inaugurated the programme. Shri Ravi Ghose, Zilla Panchayat president Kondagaon and Shri Sameer Vishnoi IAS Collector, Kondagaon were present during the occasion.

CDB, DSP Farm, Kondagaon displayed different varieties of tender coconut, coconut by-products, value added products and coconut handicraft items in the stall.



Technical enquires were clarified and publications on coconut cultivation technology, coconut products, CDB schemes and coconut journals were distributed to the visitors. More than 10000 people visited the stall.

Cabinet approves hike in MSP for Copra for 2017 season

The Cabinet Committee on Economic Affairs, chaired by the Prime Minister Shri Narendra Modi, has given its approval for the Minimum Support Price (MSP) for Fair Average Quality (FAQ) of "Milling Copra" to Rs.6500/- per quintal for 2017 season from Rs. 5950/-per quintal in 2016. The MSP for FAQ of "Ball Copra" has been increased to Rs.6785/- per quintal for 2017 season from Rs. 6240/- per quintal in 2016.

The MSP of Copra is expected to ensure appropriate minimum prices to the farmers and step up investment in coconut cultivation and thereby production and productivity in the country.

The approval is based on the recommendations of Commission for Agricultural Costs and Prices (CACP). CACP, which is an expert body that takes into account the cost of production, trends in the domestic and international prices of edible oils, overall demand and supply of copra and coconut oil, cost of processing of copra into coconut oil and the likely impact of the recommended MSPs on consumers, while recommending the MSPs.

The National Agricultural Cooperative Marketing Federation of India Limited (NAFED) and National Cooperative Consumer Federation of India Limited (NCCF) would continue to act as Central Nodal Agencies to undertake price support operations at the Minimum Support Prices in the Coconut growing states.

Source: Press Information Bureau

Coconut handicrafts training programme

Coconut Development Board, Regional Office, Patna organized coconut handicrafts training programme during 2nd - 7th March 2017 at Munger District Bihar. The programme was inaugurated by Shri Sanjeev Kumar, D.D.M., National Agricultural Bank for Rural Development (NABRD), Munger Shri. Satayanarayan, Senior Manager District Industry Munger and Shri. Rajeev Bhushan Prasad, Deputy Director, Coconut Development Board, Regional Office Patna, attended the programme. Shri. Nikunj Bihari was the master



trainer and 15 trainees attended the training. Shri. Rajeev Bhushan Prasad in his introductory remarks briefed on the importance of coconut handicrafts training and CDB schemes. Shri. Pankaj Kumar T.O, Patna proposed vote of thanks.

Market review – February 2017

Domestic price



Coconut Oil

During February 2017, the price of coconut oil opened at Rs. 14400 per quintal at Kochi and Alappuzha markets and Rs.14500 per quintal at Kozhikode market. The overall price trend of coconut oil at all markets expressed a downward trend during the month.

The price of coconut oil closed at Rs.12800 per quintal at Kochi market, Rs.12900 per quintal at Alappuzha market and Rs.13200 per quintal at Kozhikode market with a net loss of Rs.1200, Rs.1500 and Rs.1300 per quintal at Kochi, Alappuzha and Kozhikode markets respectively.



The price of coconut oil at Kangayam market in Tamilnadu, which opened at Rs.13600 per quintal, also expressed a declining trend during the month. The price closed at Rs.11600 per quintal with a net loss of Rs.2000 per quintal.

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

	Kochi	Alappuzha	Kozhikode	Kangayam
01.02.2017	14400	14400	14500	13600
05.02.2017	14500	14500	14500	13000
12.02.2017	13700	13900	14300	12200
19.02.2017	13400	13400	13700	12000
26.02.2017	12900	12900	13200	11533
28.02.2017	12800	12900	13200	11600

Milling copra

The price of milling copra at major markets moved in tune with the prices of coconut oil expressing an overall

downward trend at all markets. During the month, the price of milling copra opened at Rs.9700 per quintal at Kochi, Rs.9400 per quintal at Alappuzha and Rs.9300 per quintal at Kozhikode markets. During the first week, the price of milling copra increased slightly to Rs.9800 at Kochi market and to Rs.9450 per quintal at Alappuzha market. But the trend was reversed from the second week onwards depicting a downward movement. At Kozhikode market also the prices expressed a downward trend during the month. The prices closed at Rs.8300 at Kochi, Rs.8250 at Alappuzha and Rs.8350 at Kozhikode



markets with a net loss of Rs.1400 per quintal at Kochi, Rs.1150 per quintal at Alappuzha and Rs.950 per quintal at Kozhikode markets.

At Kangayam market in Tamilnadu, the prices opened at Rs.9200 and closed at Rs. 8100 per quintal with a net loss of Rs.1200 per quintal. The prices expressed a downward trend similar to that of the prices quoted in Kerala markets.

	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.02.2017	9700	9400	9300	9200
05.02.2017	9800	9450	9250	8900
12.02.2017	8900	8900	9050	8700
19.02.2017	8800	8600	8700	8300
26.02.2017	8400	8250	8350	8000
28.02.2017	8300	8250	8350	8100

Edible copra

The price of Rajapur copra at Kozhikode market which opened at Rs.9500 per quintal expressed a declining trend during the month and closed at Rs.8450 with a net loss of Rs.1050 per quintal. The price seems to express a slight upward trend in the coming days as it closed with a slight increase.

Table3 :Weekly of price of edible copra at Kozhikode market (Rs/Quintal)

01.02.2017	9500
05.02.2017	9250
12.02.2017	8700
19.02.2017	8500
26.02.2017	8400
28.02.2017	8450

Ball copra

The price of ball copra at Tiptur market opened at Rs.9100 per quintal, expressed a downward trend during the first fortnight of the month and closed at Rs.7500 with a net loss of Rs.1600 per quintal.

Table 4 : Weekly of price of Ball copra at major markets in Karnataka (Rs/Quintal)

	Tiptur
01.02.2017	9100
05.02.2017	8611
12.02.2017	8000
19.02.2017	7800
26.02.2017	7500
28.02.2017	7500

Dry coconut

At Kozhikode market the price of dry coconut opened at Rs.7850. The price expressed a declining trend and closed at Rs.6950 with a net loss of Rs.900 per thousand nuts.

Table5 : Weekly of price of Dry Coconut at Kozhikode market (Rs/1000 coconuts)

01.02.2017	7850
05.02.2017	7850
12.02.2017	7050
19.02.2017	6950
26.02.2017	6950
28.02.2017	6950



Coconut

At Nedumangad market, the price opened at Rs. 15000 and closed at same price per thousand nuts. At Bangalore APMC, the price opened at Rs.10000 per thousand nuts and closed at the same price. At Mangalore APMC market the price of partially dehusked coconut opened at Rs.15000 per thousand nuts and closed at Rs.20000 per thousand nuts with a net gain of Rs.5000.

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

	Nedumangad	Banglore	Mangalore (Grade-1)
01.02.2017	NR	10000	15000
05.02.2017	15000	10000	15000
12.02.2017	15000	10000	20000
19.02.2017	15000	10000	20000
26.02.2017	15000	10000	NR
28.02.2017	15000	10000	20000

Tender coconut

The price of tender coconut at Maddur APMC market in Karnataka opened and closed at Rs.10000 per thousand nuts. The price of tender coconut remained constant throughout the month.

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

01.02.2017	10000
05.02.2017	10000
12.02.2017	10000
19.02.2017	10000
26.02.2017	10000
28.02.2017	10000

International price

Coconut oil

The international (CIF Rotterdam) and domestic price of coconut oil at Philippines, Indonesia and India expressed a downward trend during the month. The domestic price of coconut oil in India opened at US\$ 2155 and closed at 1930 per MT. The price of coconut oil quoted at different international/ domestic markets is given below.

Table 8: Weekly price coconut oil in major coconut oil producing countries October 2016

	International Price(US\$/MT)	Domestic Price(US\$/MT)		
	Philippines/ Indonesia (CIF Europe)	Philippines	Indonesia	India*
04.02.2017	1806	1780	1778	2155
11.02.2017	1785	1744	1692	2043
18.02.2017	1693	1658	1692	2001
25.02.2017	1588	1540	1530	1930

* Kochi Market

Copra

The domestic price of copra at Philippines, Indonesia and India expressed a downward trend during the month. Price of copra in Srilanka expressed a slight fluctuating trend.

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

	Domestic Price(US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
04.02.2017	1084	1006	1230	1457
11.02.2017	1060	979	1230	1328
18.02.2017	1006	934	1310	1314
25.02.2017	916	916	1280	1257

* Kochi Market

Desiccated coconut

The FOB price of desiccated coconut in India during the month of February was very competitive compared to the prices of major DC exporting countries.



Table 10: Weekly price of desiccated coconut in October 2016

	Domestic Price (US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
04.02.2017	2508	2300	2588	1899
11.02.2017	2508	2450	2806	1844
18.02.2017	2563	2450	2680	1877
25.02.2017	2535	2450	2776	1706

*FOB

Coconut

Among major coconut producing countries, the price of coconut at Philippines and Indonesia expressed an upward trend. At Srilanka a minute fluctuation in the prices of dehusked coconut was observed during the month. The domestic price of dehusked coconut in India expressed a declining trend during the month.

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

Date	Domestic Price (US\$/MT)			
	Philippines	Indonesia	Srilanka	India*
04.02.2017	242	240	266	446
11.02.2017	243	247	267	403
18.02.2017	247	247	280	396
25.02.2017	250	247	266	382

*Pollachi market

Coconut shell charcoal

The domestic price of coconut shell charcoal in India expressed an upward trend during the month and was competitive compared to the prices quoted by major coconut producing countries. Indonesia's price was the highest among major coconut shell charcoal exporting countries.

Table 12: Weekly price of coconut shell charcoal during October 2016

Date	Domestic Price(US\$/MT)			
	Philippines	Indonesia	Srilanka	India
04.02.2017	340	438	338	268
11.02.2017	388	431	329	291
18.02.2017	388	448	338	291
25.02.2017	388	448	338	292

*Kangayam



Monthly operations in coconut gardens-April

Andaman & Nicobar Islands:

Fill the previously prepared pits half with a mixture of wood ash, sand and surface soil. Plant the seedlings in a small hole dug in the centre of the half filled pit. Provide bunds around the pits to prevent the entry of rain water. Clean the crowns of all the bearing palms and fill 2-3 upper most leaf axils with sand and naphthalene balls (2-3 nos) to prevent the attack of rhinoceros beetles.

Andhra Pradesh: Prepare nursery beds. If there is termite problem in the area, raise the nursery in sandy soil or apply thick layers of river sand on the beds or drench the nursery beds with 0.05% chlorpyrifos twice at 20 to 25 days interval. Sow seed nuts in the beds. Plant one-year-old seedlings in the main field. If coconut husk is available bury it in trenches taken 3m away from the trunk between rows of palms or in circular trenches, taken around the palm at a distance of 2m. The husk is to be placed in layers with concave surface facing upwards and buried. The husk helps in the retention of moisture and supplies nutrients especially potash. The beneficial effect of husk burial will last for 5 to 7 years. Apply the first dose of fertilizers in the basins, i.e. 400 g urea, 700 g single Superphosphate (SSP) and 750g muriate of potash (MOP) per adult palm. Apply green leaf manure @ two headloads per palm, cover it with soil and irrigate the basins. If cattle manure is available, apply 25 kg along with the above manures. Apply ¼ cartload of tank silt depending on its availability. If the

attack of black-headed caterpillar is noticed, cut down and burn the severely affected lower leaves to arrest the spread of the pest. Spray the affected palms with 0.02% dichlorvos or 0.05% malathion. Liberate stage specific parasites on older palms according to stage of the pest. In a multi-stage 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. If the attack of mite is noticed, spray neem oil formulation containing 0.004% azadirachtin (neemazal T/S 1% @ 4 ml/ litre of water). The spray droplets are to be directed towards the second to fifth immature bunches.

Assam: Continue transplanting of seedlings in the main field. Regularly drain out accumulated rainwater from the pits of newly transplanted seedlings. Clean the crowns of the palms and tie or prop up bunches to prevent buckling. Take preventive measures against diseases. If termite attack is noticed, adopt soil drenching of the nursery beds and basins of newly transplanted seedlings with 0.05% chlorpyrifos twice at 20 to 25 days interval. Against leaf rot disease, pour contaf 5EC @ 2ml/300 ml of water or mancozeb 3g in 300 ml water per palm around the base of the spindle leaf after cutting and removing the rotten portion.

Bihar / Madhya Pradesh / Chhattisgarh: Increase the frequency of irrigation. Start transplanting of seedlings in the main field by taking pits of 1.2m x 1.2m

x 1.2m size in laterite soils and 1m x 1m x 1m size in sandy loam soils. Search for the incidence of termite attack/fungal diseases and adopt recommended control measures.

Karnataka: Sow the seed nuts before the onset of monsoon and irrigate them if necessary. Irrigate the seedlings if dry spell prevails. Clean the irrigation channels and repair the bunds. Continue irrigation, if the monsoon has not set in. Fresh planting may be done in previously prepared pits after filling up half of the pit with wood ash, cattle manure and surface soil. Apply the first dose of fertilizers, organic manure (FYM) @ 50 kg and neem cake @ 5 kg per palm. Give a prophylactic spray with 1% bordeaux mixture or any other copper fungicide against fungal diseases. If the attack of mite is noticed, spray neem oil formulation containing 0.004% azadirachtin (neemazal T/S 1% @ 4 ml/ litre of water). The spray droplets are to be directed towards the second to fifth month old bunches.

Kerala / Lakshadweep: Take basins around the palms at 2m radius and sow green manure crop in the basins if it has not been sown in the main field. Husk burial can be done to conserve the soil moisture. Application of sufficient quantities of organic manures and balanced dose of inorganic fertilizers in the basins is recommended to improve nutrient status of the soil to nourish the palms. Apply organic manure (FYM) @ 50 kg and neem cake @ 5 kg per palm per year. Search for leaf eating caterpillars and destroy them by cutting down and burning the severely infested lower leaves. Spray the affected palms with 0.02% dichlorovos or 0.05% malathion. Liberate stage specific parasites on older palms according to the stage of the pest. In a multi-stage 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. Search for rhinoceros beetle and red palm weevil affected palms. The black rhinoceros beetle should be hooked out and destroyed. Inject the red palm weevil attacked palms with 1% carbaryl using a funnel. Search for bud rot infection. If infection is found, cut and remove the rotten tissues and treat with bordeaux paste and spray the neighbouring palms with 1% bordeaux mixture as a prophylactic measure. If the attack of mite is noticed, spray neem oil formulation containing 0.004% azadirachtin (neemazal T/S 1% @ 4 ml/ litre of water). The spray droplets are to be directed towards the second to fifth month bunches.

Maharashtra / Goa / Gujarat: Plough the land once or twice and remove the grasses. Sow green manure crops such as sunnhemp, dhaincha, sesbania or kolinji @ 28 to 34 kg per hectare. Apply fertilizers if not given earlier.

Orissa: Start planting seedlings in the main field

by taking pits of 1.2m x 1.2m x 1.2m size in laterite soils and 1m x 1m x 1m size in sandy loam soils. Dig the basins around the palms. Apply green leaf manure and cattle manure at the beginning of the southwest monsoon. First apply the green leaves and then cattle manure and cover them with soil. Apply the first dose of fertilizers @ 250g urea, 500 g single superphosphate (SSP) and 500 g muriate of potash (MOP) per adult palm. For younger palms apply $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of the above dose of fertilizers to the one-year, two year and three-year old palms, respectively.

Tamil Nadu / Puducherry: Start sowing of seed nuts in the nursery. Continue irrigation in the garden. Apply 80 litres of water/day/palm in drip-irrigated gardens or apply 500 litres of water/palm through basin irrigation once in 6 days in the western region and once in 5 days in eastern region. Start sowing of green manure crops like sunnhemp and dhaincha in the basins of palms. Search for the black-headed caterpillars. If infestation is noticed, cut down and burn the severely infested lower leaves and spray the affected palms with 0.02% dichlorovos or 0.05% malathion. After 3 weeks of spraying, release larval or pupal parasites according to the stage of black-headed caterpillar. If grey leaf blight is observed spray palms with copper oxychloride @ 0.3% or carbendazim 0.1% or root feed with 2 g carbendazim in 100 ml water. Ensure 45 days interval between root feeding and next harvest of nuts.

Tripura: Prepare nursery beds for sowing of seednuts. In areas of poor drainage make raised seedbeds. The seedbeds are to be treated with 0.05% chlorpyrifos twice at 20 to 25 days interval to protect the nuts from the attack of termite. Remove the weeds from the garden and improve the drainage facilities. Transplanting of new seedlings should be taken up during this month. Spray 1% bordeaux mixture if bud rot is prevalent in the area. To protect the palms from rhinoceros beetle and red palm weevil fill the top 3-4 leaf axils of the palm with a mixture of 25g sevidol (8G) with 250g fine sand.

West Bengal: Sow seednuts before the onset of monsoon and irrigate them if necessary. Dig out pits for new planting if it is not yet done. Prepare bunds and clean the irrigation channels. Continue irrigation if the monsoon has not set in. Apply the first dose of fertilizers if not done. Give palms a prophylactic spray with 1% bordeaux mixture to prevent bud rot and other fungal diseases (Dissolve 10 g of copper sulphate in 500 ml water and 10 g quick lime in another 500 ml water, each in separate nonmetallic pots. Pour the copper sulphate solution into the lime solution to get one litre Bordeaux mixture of 1% concentration. Check the acidity by dipping a knife or blade in the solution; if rusting on knife/blade is seen add some more lime solution.