

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 evapotranspiration 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,

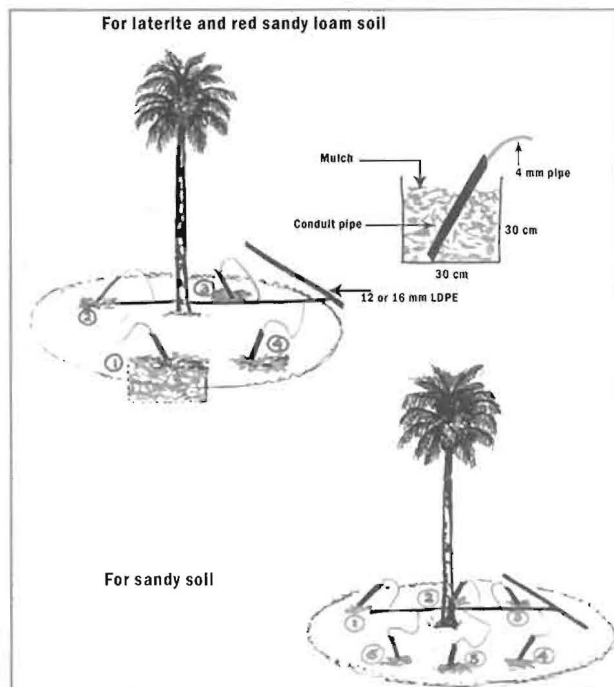


Fig 1. Drip irrigation layout in the coconut basin

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.

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. ■

