Drip Irrigation for coconut

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Coconut Palm (Cocos nucifera L) is one of the thirstiest denizens of the plant kingdom and it requires large quantities of water (about 90 litres of water per palm per day) for its growth and development. Being a perennial crop, having continuous growth activities, by producing one leaf, one spadix, and one bunch every month, it is but natural that coconut palm has a high requirement of water and water is required throughout its growing period. It is often said that no single factor can affect coconut palms to the same extent as adequate supply of water and rainfall has more impact on coconut production than any other factors. As the palm stores little moisture and has no tap root, it cannot tolerate dry spell of more than three months and hence it is not suited for regions with long and pronounced dry spells, during which water table goes down considerably. Adequate and assured supply of water throughout the year, either by rainfall, or by irrigation or by subsoil moisture is imperative for the successful cultivation of coconut palms. That is why our forefathers planted the coconut near the rivers, tanks and wells where there was assured supply of water throughout the year.

Coconut and Water

Water is the basic requirement in the hierarchical needs of coconut palm. It is a plant food that carries plant nutrients into the plant. It keeps the plant cells turgid, a condition necessary for their normal functioning. Water also acts as a coolant to dissipate the excess heat generated in the plant body and thus precludes the rise in temperature of the plant tissues. Water is essential for the metabolism of coconut palm.

Water requirement of coconut palm is governed by several factors such as season, soil, variety, soil moisture level etc. Copeland (1931) estimated that the daily loss of water from a mature coconut palm varies from 28 to 74 litres under west coast conditions. Mohandass *et al* estimated that the water requirement of coconut under Coimbatore conditions is 90 litres water per palm per day, based on the crop evapotranspiration concept. Saseendran and Jayakumar (1998) computed the mean

annual consumptive use of water by coconut palm as 1126 mm (37 litres of water per palm per day for a basin area of 12 square metres around the palm). All these studies reveal the importance of water in coconut cultivation.

Drip Irrigation (Micro Irrigation)

In Tamilnadu state, where the annual rainfall is less than 1000 mm, economic production of coconut is possible only under irrigation. But the available water resources in Tamilnadu are also limited. Tamilnadu, with a population of 7% and a land area of 4% has only 3% of the country's water resources. Per capita availability of water in Tamilnadu is only 800 cubic metres per annum, which is 25% of the Indian average of 3200 cubic metres per annum. Next to Rajasthan, Tamilnadu is the most acute water deficit state in India. Under such a situation, drip irrigation is a boon to coconut farmers. Drip irrigation is the most efficient method of irrigation, first developed in Israel in 1959, by an irrigation engineer, Shymcha Blass and is now being used extensively in several countries. It has a water use efficiency of 90% as against 30% of the surface method of irrigation. It is most suited for widely spaced crops like coconut, banana, mango, pomegranate, grapes etc.

In drip irrigation, water is applied directly to the root zone of each plant, at frequent intervals (daily) in precise quantities as per plants' water requirements.

Water is applied at a slow rate, drop by drop, over a limited area of 30-35% of root zone of each plant so that 30-35% of roof zone is kept near field capacity. As such there is no percolation loss of water in drip irrigation system.

Water is applied through a low pressure net work of pipes called main, submain and lateral lines with emitters or drippers spaced along the lateral lines. There is no conveyance loss of water in drip irrigation system.

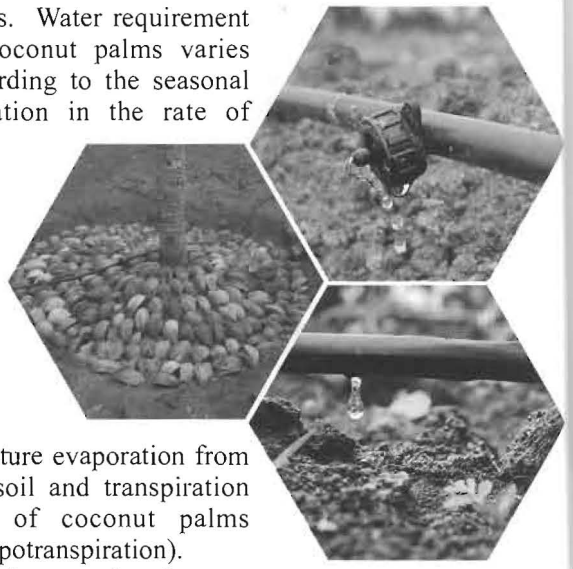
In drip irrigation system, crop plants never undergo water stress thereby enabling them to achive optimum growth and high yields with better produce quality. Drip irrigation is suitable for undulated terrains without land levelling.

Fertigation is possible in drip irrigation system. Application of water soluble fertilizers through drip irrigation system is known as fertigation. In fertigation fertilizer use efficiency is as high as 90% compared to 40 – 50% in conventional methods of fertilization.

Research findings on drip irrigation

Numerous research studies on drip irrigation for coconut have been conducted in various Coconut Research Stations in India. Results of these research studies reveal the following findings.

Drip irrigation is highly suitable for coconut crop because of its wide plant spacing of 7.5m x 7.5m, its high water requirement and its high susceptibility to water stress. Water requirement of coconut palms varies according to the seasonal variation in the rate of



moisture evaporation from the soil and transpiration rate of coconut palms (Evapotranspiration).

In places of adequate availability of water for irrigation, drip irrigation @ 100 percent of open pan evaporation is desirable. In places of water scarcity, drip irrigation @ 66 percent of open pan evaporation is recommended. Drip irrigation @ 33 percent of open pan evaporation is the barest minimum of water required to save the palms from drought.

Four drippers are required for sandy loam soils and laterite soils whereas six drippers are necessary for sandy soils to wet adequate volume of active root zone of the palm. A discharge rate of 4 litres of water per hour per dripper is desirable so as to get about 30% of wetted soil volume within the active root zone of the palms, which is found adequate for coconut palms. This discharge rate helps to reduce the clogging of drippers. It is advisable to allow the water to drip at a depth of 30 cm below the soil surface. Such a subsurface placement of water wets 35% more volume of soil than surface placed water. This is possibly due to the reduced evaporation of water from the subsurface.

Subsurface placement of water can be achieved by digging small pits of 30 x 30 x 30 cm size and placing a PVC conduit pipe of 12 mm diameter and 40 cm length in the pits in a slanting position and filling the pits with coir pith / saw dust / rice husks and leaving 5 cm of the conduit pipe above the ground surface. Coir pith / sawdust / rice husks in the pits is pressed firmly and packed tightly all around the conduit pipe and the top portion of the pit is covered with 10 cm thick layer of the soil and pressed firmly to flush with the ground surface. 4 or 6 such pits per palm, as the case may be, according to the number of drippers used, equally spread in the basin area around the palm, are prepared for this purpose. The dripper / micro tube is placed inside the conduit pipe so as to allow the water to drip at a depth of 30 cm below the soil surface. (Figure 1)

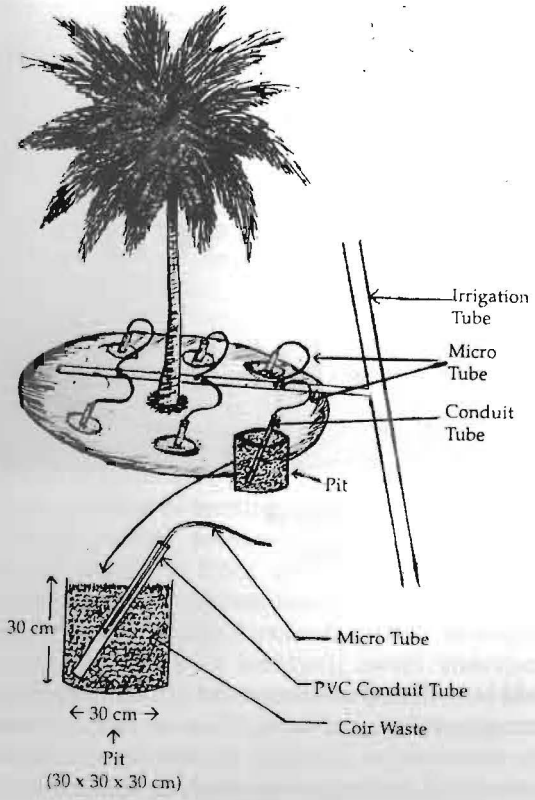


Figure – 1 : Drip irrigation for cocount

Studies on coconut root absorption indicate that the active absorption zone of the coconut roots is found at 0.75 m to 1.25 m away from the bole of the palm. It is therefore advisable to place the drippers / microtubes in the centre of the active absorption zone, i.e. at a distance of 1m away from the bole. Hence the pits for placing the conduit pipes / drippers are dug at a distance of 1m away from the bole.

Mulching the basin area with coconut leaves or coir pith improves the performance of drip irrigation system, possibly by lowering soil temperature and conserving soil moisture. There is a saving of 30 – 40% water and about 80 man days of labour per hectare in drip irrigation for coconut compared to conventional basin irrigation system. Weed growth in drip irrigated coconut garden is lesser by 20-30% which reduces the weeding cost.

Drip irrigation is suited to any type of soil, varying from very porous sandy soils to less porous clay soils. However it is highly beneficial to porous soils such as sandy soils and sandy loam soils. In drip irrigated coconut gardens, the soil contains about 60 percent water and 40 percent air. Such optimum availability of water and air in the soil enhances the functioning of coconut roots and increases water use efficiency and coconut yields. In drip irrigated coconut gardens, part of the palm root zone does not receive water. Coconut roots in this dry zone send root-shoot signals to make the stomata in coconut leaves partially close, stimulating mild stress condition. This stress condition is favourable to high water use efficiency (both intrinsic and instantaneous). Thus drip irrigation increases water use efficiency not only at field level but at plant and leaf level also.

In can be rightly concluded that in drip irrigation system available water is used efficiently with negligible loss. Because of the presence of dry zone in the root system drip irrigation possibly acts as a stomatal regulation system to provide optimal physiological efficiency for higher water use efficiency and better nut yields. Coconut crop with a coverage of 22% of area under drip irrigation tops the list. This is mainly because of higher water requirement of coconut palm and its high susceptibility to water stress.

Drip irrigation for coconut in Tamilnadu

Based on the results of numerous research studies conducted in drip irrigation for coconut, TamilNadu Agricultural University (TNAU) recommends the following irrigation schedule for coconut under drip irrigation system.

Western Region of Tamilnadu		
	Months of the Year	Quantity of Water per day per palm
1.	February to May	65 Litres
2.	January, August and September	55 Litres
3.	June, July, October, November & December	45 Litres
Eastern Region of Tamilnadu and Puduchery State		
	Months of the Year	Quantity of Water per day per palm
1.	March to September	80 Litres
2.	October to February	50 Litres

Realising the importance of drip irrigation in agriculture, Government of Tamilnadu gives 100% financial subsidy to small and marginal farmers and 75% subsidy to medium and big farmers to install drip irrigation system in their farms. The cost of installation of drip irrigation system in coconut gardens comes to Rs.20,000 to 25,000 per hectare. The financial subsidy by the Government reduces the financial burden of the farmers. Bank loans are also available to install drip irrigation.

Drip irrigation is indeed a boon to coconut farmers. It helps the coconut farmers in a big way to increase production and productivity of their coconut gardens. It effectively saves the coconut palms from drought. ■