A Simple Technique to Determine the Number of Emitters Required for a Coconut Palm Under Drip Irrigation

A. C. Mathew and H. P. Maheswarappa
Central Plantation Crops Research Institute, Kasaragod - 671 124

Introduction

Drip irrigation is gaining importance among coconut growers especially where the available water resources is limited. Water saving under drip irrigation is mainly because of the partial wetting of root zone. The pattern of wetting front will be different for different soils. Laterites, sandy loam and littoral sandy soils are the important coconut growing soils on the west coast of India (Khan *et. al.*, 1978). The volume of wetted soil from a single dripping point is a function of emitter discharge rate, total water applied and infiltration rate of the soil (Warrick, 1986). Among these various factors farmer does not have much control on the infiltration rate of the soil even though he may be able to alter the same by adding organic matter etc. to the soil. Total water applied is directly proportional to the crop water requirement of coconut palm. This leaves only one factor, discharge rate of emitter, which can be adjusted to get optimum wetted volume. Once this is worked out it is possible to find out the number of dripping points required to wet a certain percentage of the root zone volume. This should be a pre-requisite before opting for such an efficient yet costly drip irrigation system to make use of its full potential.

Materials and Methods

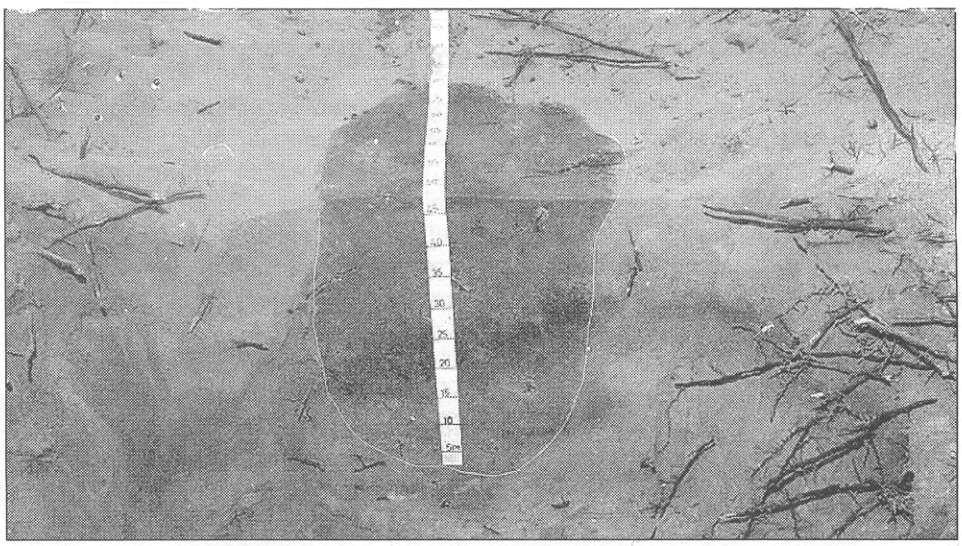
Field studies in this regard were conducted at Central Plantation Crops Research Institute, Kasaragod for two major soil types viz. sandy loam and littoral sand. Moisture movement from a single dripping point under drip irrigation was observed during the irrigation season in coconut garden.

In order to get a uniform emitter discharge rate, constant water head was maintained in the water storage tank by providing a float. Water was conveyed to the palm through 50 mm (TD) HDPE main and 16 mm LLDP laterals. Tap type emitters were used to supply water to the palms. Two dripping points, one each at the opposite sides of a coconut basin were provided. Eight litres of water per dripper per day was applied. This is equivalent to applying 32 litres of water per palm per day through four dripping points as suggested by earlier research worker (Varadhan and Madhava Chandran, 1991). The required amount of water was given as follows :

Soil Type	*Discharge rate (lit. per hour)*
Littoral sand	1.5, 2 & 4
Sandy loam	2 & 4

Discharge rate of each emitter was adjusted daily before water application to keep it constant. Irrigation was given daily till the completion of the experiment. The horizontal and vertical movement of water was observed 24 hours after irrigation. This was done daily for five days in littoral sand and on the 1st, 4th, 8th, 12th and 16th days in sandy loam soil. By this time the wetting front crossed the root zone depth of one metre.

The following procedure was adopted for determining the wetting front. The top soil was removed up to a depth of 15 cm around the dripping point. The lateral (horizontal) movement of water was then measured. A rectangular trench of 50 cm width, 100 cm depth and 150 cm length was taken keeping the dripping point at the middle of one edge of the trench. The wetting front was marked on a transparent plastic sheet. Volume of root zone soil wetted was calculated from this. This study was continued till



Horizontal and vertical movement of water from a single dripping point

the wetting front crossed root zone depth.

Results and Discussion

In sandy loam soil the horizontal movement of water front was higher than the vertical movement for 4LPH, where as it was the reverse for 2LPH (CPCRI Annual Report - 1997). Wetting front moved quite differently in sandy soil. Here for all the discharge rates (1.5, 2 & 4LPH) vertical movement of water front was higher than horizontal movement. (Maheswarappa *et. al.*, 1997).

The maximum vertical and horizontal movement of water (112 cm and 84 cm respectively) was with 4LPH discharge rate at the fifth day in sandy soil. Vertical and horizontal movement was 116 cm and 118 cm respectively for 4LPH discharge rate in sandy loam soil on the 12th day. In sandy loam soil it took 12 days for the wetting front to cross the root zone whereas in sandy soil it took just five days only.

Percentage of wetted soil in active root zone

The percentage of wetted soil is determined by dividing the wetted volume by the volume of soil within the root zone (Vermeiren and Jobling, 1984). It is the vertical and horizontal movement of water which decides the percentage of wetted soil. Only drip irrigation provides a complete control of water movement in a three dimensional space. This helps to confine the applied water within the active root zone. The single most important criteria in drip irrigation evaluation is the percentage of wetted soil within the active root zone of a crop. However an optimum minimum value for this has not yet been established. From presently available information it could be around 30-35 percent (Vermeiren and Jobling, 1984).

The present studies showed that about 31% of the active root zone of coconut could be wetted by the application of 32 litres of water per palm per day through four dripping points at a discharge rate of 4LPH in sandy loam soil. For the same amount of water, number of dripping points and discharge rate this was only 14.6%, in sandy soil.

Conclusion

The practice of providing four dripping points per coconut and operating the same at 4LPH discharge rate is quite sufficient in sandy loam soil whereas the number of dripping points should be higher in light soils. Any farmer who wants to adopt drip irrigation can follow this procedure in his field before laying out the system to determine the number of dripping points required in his field.

References

Maheswarappa. H. P., Mathew A.C., and Gopalasundaram P. 1997. Moisture movement in active root zone of coconut under drip irrigation in littoral sandy soil. J. Plantn. Crops 25 (2) : 201-204.

CPCRI Annual Report 1993.

Vermeiren. L., and Jobling. G. A. 1984. Localized Irrigation, FAO irrigation and drainage paper 36, FAO, Rome, pp. 203.

Khan H. H., Sankara Narayanan. M. P., and Narayanan. K. B. 1978. Characteristics of coconut soils of India. In Proc. PLACROSYM I. J. Plantn. Crops. pp 54-79.

Varadhan K. M., and Madhava Chandran K. 1991. Irrigation requirement of coconut under drip method. Proc. Natn. Symp. Coconut Breeding and Management, K.A.U., Trichur pp: 281-282.

Warrick. A.W., 1986. Design Principles. In (F.S. Nakayama and D.A. Bucks. eds.) Trickle Irrigation for crop production. pp. 93-116. Elsevier Science Publishers, Amsterdam, The Netherlands.

Meeting of BIMST EC Expert Group

The first meeting of the BIMST-EC Expert Group on cococnut and spices was held at New Delhi on 28th March 2001. Dr.P. Rethinam, (Chairman, Coconut Development Board) who was elected as Chairman of the Expert Group presided over the meeting. Shri.S.S. Kapur, Jt. Secretary, Department of Commerce, Government of India inaugurated the meeting. In his address Sri. Kapur expressed the hope that the deliberations of the meeting will lead to drawing up of a detailed and pragmatic action plan for enhancing co-operation amongst member countries in the field which would inter-alia include sharing of information in the fields of research and development, transfer of technology, strategies and sharing of experiences for disease management and improved productivity technologies, human resource development/identification of necessary steps for promotion of joint venture etc. in the coconut and spices based industries. Country presentations were made by Bangladesh, India, Myanmar, Shri Lanka and Thailand. Dr. H.P. Singh, Horti. Commissioner, Govt. of India, Shri. Paramjit Singh, Dy.Commissioner, Deptt. of Ag. & Co-operation, New Delhi, Shri. R.S. Ratna, Jt. Director, Deptt. of Commerce, Government of India, New Delhi, Shri. D R K Rao, Desk Officer, Division of Horticulture, Deptt. of Agri. & Cooperation, New Delhi and Shri.L. Shivarama Reddy, Dy.Director, Coconut Development Board, Kochi also attended the meeting