

MICRO IRRIGATION FOR HYBRID COCONUT

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ABSTRACT

A field experiment was conducted in red sandy loam soil at TNAU Agricultural Research Station, Aliyarnagar to find out the water requirement for coconut through drip irrigation with Hybrid VHC-2. The drip system included 4 drippers placed 1 meter away from palm operated at discharge rate of 8 litres of water per hour. The system operated throughout the year except the period of rainfall under Aliyarnagar conditions. The data collected from 1996-97 to 1998-99 revealed that drip irrigation equal to 100% of Pan evaporation (Eo) and basin irrigation at IW/CPE ratio of 1.0 at 4 cm depth recorded higher nut yields. The average nut yields for three years with drip at 100% Eo was on par with basin irrigation at IW/CPE ratio of 1.0 at 4 cm depth. The leaf N status was better with drip irrigation at 100% Eo and basin irrigation compared to life saving irrigation treatment. The soil available N and K did not reveal any significant variation due to irrigation treatments. However, available phosphorus status was found to decrease with increasing dose of irrigation through drips. The cost of production of nuts during 1998-99 indicated that the production cost was low with basin irrigation and drip irrigation at 100 % Eo (i.e) Rs.1.99 and 2.02 respectively.

INTRODUCTION

India ranks first in coconut production with a production of 14,924 million nuts from an area of 1.9 million hectares which ranks third in the world. Tamil Nadu ranks third in terms of area (2,66,500 hectares) and second in terms of production (3097 million nuts) in the country. The productivity in India and Tamil Nadu are 7821 and 11620 nuts/ha respectively as per 1998-99 statistics. The mean annual rainfall of coconut growing areas in the state is low, varies from 700-1100 mm. and the rainfall is distributed only during the monsoon months from June to December. The crop water requirement for optimum growth and high yield is location specific and varies with climate, soil, variety/hybrid and system of irrigation. Copeland (1931) reported that a coconut palm could absorb 28 to 46 liters of water in a day. Mohandas *et.al.* (1988) estimated the transpiration rate and calculated the transpiration rate as 90 litres/palm/day at Coimbatore conditions. However, the information on seasonal water requirement for coconut through drip irrigation is not available.

MATERIALS AND METHODS

A field experiment was started during 1989 at TNAU Agricultural Research Station, Aliyarnagar, Tamil Nadu to study the water requirement through drip irrigation under AICRP Palms. The soil was red sandy loam with low (182.5 kg/ha), medium (12.5 kg/ha) and high (325 kg/ha) available N, P₂O₅ and K₂O.

The treatments are:

- I1 - Life saving irrigation
- I2 - Drip irrigation at 33% Eo (Pan Evaporation)
- I3 - Drip irrigation at 66% Eo
- I4 - Drip irrigation at 100% Eo
- I5 - Basin irrigation IW/CPE ratio of 1.0 at 4 cm depth

The experiment was originally laid out in split plot design with methods of irrigation in the Main plot and forms of fertilizer under sub-plot. The treatments under sub-plot could not be imposed after 1995 due to the non availability of NP tablets and only main plot treatments were imposed. The coconut hybrid VHC-2 was planted in the year 1989 and the palms were receiving the treatments

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Table 1. Mean monthly evaporation and quantity of water applied through drip irrigation

Month	Mean monthly evaporation (mm/day)	water applied through drip irrigation		
		33 % Eo	66 % Eo	100 % Eo
January	4.71	16	32	48
February	6.09	20	41	62
March	6.43	21	42	65
April	5.77	19	38	59
May	6.04	20	40	61
June	4.28	14	28	43
July	3.87	13	26	39
August	5.25	17	34	53
September	5.40	18	36	55
October	3.67	12	24	37
November	3.42	12	22	35
December	4.26	14	28	43

from the time of planting. The quantity of water applied through drip under various treatments was based on the 10 years average open pan evaporation data for each month (Table.1). For each palm four emitters were placed 1 meter away from the bole with equal distance between the emitters. The drip water was delivered at 20 cm depth by making a pit of 30 X 30 X 20 cm. The pit was filled with coir pith. For basin irrigation 407 liters of water per irrigation was applied in 1.8 m radius basin whenever pan evaporation reached 40 mm. The number of irrigations was given based on the pan evaporation data in different years (Table 2). The effective rainfall

was calculated based on the method suggested by USDA (1969) by taking monthly rainfall and evapotranspiration. The data collected from 1996-97 to 1998-99 are analysed and presented in this paper. The cost of cultivation was worked out by the Annuity method suggested by Sairam (1996).

RESULTS AND DISCUSSION

The annual rainfall varied from 526 to 1428 mm in different years. The rainfall was below normal during 1995-96 and 1996-97 and it was above normal during 1997-98 and 1998-99 (Mean annual rainfall was 801 mm) (Table 2). The estimated quantity of effective rainfall was 377,

Table 2. Number of irrigations given through basin irrigation, total quantity of water supplied/palm, actuals and effective rainfall

Period	Year			
	1995-96	1996-97	1997-98	1998-99
	Number of irrigations			
July - September	8	8	6	6
October - December	11	7	3	6
January - February	8	6	8	7
March - June	13	17	16	17
Total	40	38	33	36
Water applied (litres/palm/year)	16280	15466	13431	14652
Actual rainfall (mm)	526	624	1428	1175
Effective Rainfall (mm)	377	382	630	556
Quantity of water contributed from effective rainfall (litres/palm/year)	3836(19%)	3886 (20%)	6410(32%)	5657(27%)
Total	20116	19352	19481	20309

Table 3. Water applied through drip irrigation at 100 % Eo

Period	1995-96	1996-97	1997-98	1998-99	Mean
July - Sep	3015	3338	2926	3298	3144
Oct - Nov	3108	1971	1567	1653	2074
Jan - Feb	3286	3224	3224	3224	3240
Mar - June	5230	5995	5194	5541	5490
Total	14639	14528	12911	14652	14182
water saving when compared to basin irrigation	1641	938	520	936	1258
% of saving	10	6	4	6	6.5

382, 630 and 556 mm during 1995-96, 1996-97, 1997-98 and 1998-99 respectively. The percentage of effective rainfall decreased with increased quantity of rainfall. The total number of irrigations given with IW/CPE ratio in basin irrigation treatment varied from 33-40 in different years and it was lowest during 1997-98 (Table.2). The number of irrigations was almost similar during July-September and January-February in all the years. Variation in number of irrigations occurred during two periods i.e. October-December and March-June. This was due to the variation in the North-East monsoon rainfall and summer showers during April.

The total water received by a palm through basin irrigation varied from 19352 to 20309 litres in different years. It was lowest during 1996-97 and highest during 1998-99.

The quantity of water applied to a drip irrigation (Drip 100% Eo) treatment are 14639, 14528, 12911 and 13716 during 1995-96, 1996-97, 1997-98 and 1998-99 respectively (Table3). Though 100 % evaporation was replaced based on the monthly average the quantity was applied was slightly less when compared to basin irrigation in different years. The quantity of saving of water per palm varied from 520 to 1641 litres in different years. The quantity of water applied through drip varied highly during North East Monsoon period (1567- 3108 litres/palm) and this was due the high variation in rainfall pattern.

The number of bunches harvested/palm/year ranged from 7.6 to 13.8 in different years. Basin irrigation at IW/CPE ratio of 1.0 and drip irrigation at 100% Eo produced more number of bunches in all the years followed by drip irrigation at 66%

Eo. Number of female flowers varied from 87 to 349 in different years and life saving irrigation treatment produced lowest number of female flowers. Drip irrigation at 100% Eo and basin irrigation produced more number of female flowers. This would have been due to the adequate supply of water and nutrients which resulted in higher number of bunches and female flowers in the above two treatments.

Leaf nutrient analysis data indicated that basin irrigation and drip irrigation at 100% Eo recorded 2.06 and 1.90% of N which were higher than other treatments. The leaf phosphorus status was not influenced due to irrigation. A similar trend of result was obtained for leaf potassium status. Higher leaf N content under these treatments may be due to the adequate availability of soil moisture which would have resulted in increased uptake of N. Sharda and Gupta (1975) reported that N uptake increases with adequate levels of irrigation.

Analysis of available soil nutrient status did not show any significant variation among the treatments. However P and K status were higher in the life saving irrigation treatment.

Nut yield for three years from 1996-97 to 1998-99 indicated that maximum yields were recorded with basin irrigation at IW/CPE ratio of 1.0 and drip irrigation at 100% Eo. These treatments were significantly superior to other treatments. This indicated the maximum response for irrigation with the above two treatments. Drip irrigation at 66% Eo recorded more yield than drip irrigation at 33% Eo and significantly lesser yield than drip irrigation at 100% Eo. This indicates that VHC-2 hybrid needs 100% replacement of

Table 4. Economic analysis of drip and basin irrigation methods

Treatments	Nut yield /nuts/ ha/ year	Gross income/ ha	Cost of cultivation/ ha	Net income	Cost of production per nut
Life saving irrigation	7875	19688	39192	-19504	4.97
Drip at 33% Eo	11375	28438	48530	-20092	4.26
Drip at 66% Eo	15225	38063	50286	-12223	3.30
Drip at 100% Eo	25200	63000	51106	+11894	2.02
Basin irrigation	25900	64750	51706	+13044	1.99

Coconut price : Rs.2.50 per nut.

Month	Quantity of water to be applied (Litres/palm/day)
February, March, April, May	65
Jan, Aug, Sep	55
June, July, Oct, Nov, Dec	43

water for increased yield. Dhanapal *et al.*, (2000) reported that 66% of Eo was better for WCT palms under Kerala conditions with a average nut yield of 74.8 nuts/palm/year.

Economic analysis of the data for the year 1998-99 revealed that the gross income was more with basin irrigation and drip irrigation at 100% Eo (i.e.) Rs.64,750 and Rs.63,000 respectively (Table 4). The cost of cultivation was almost similar during the year 1998-99 in basin irrigation and drip irrigation treatments. The net income data indicated that as per the present trend of prices the treatments viz, life saving irrigation, Drip at 33% and 66% Eo recorded a loss of Rs.19,504, 20,092 and 12,223 respectively. Basin irrigation and drip at 100% Eo treatments recorded a net profit of Rs.13,044 and Rs.11,894 respectively. The cost of production of nuts indicated that the production cost was low with basin irrigation and drip irrigation at 100% Eo (i.e.) Rs.1.99 and 2.02/nut respectively. Other treatments recorded higher production cost than the farm gate price, which resulted in income loss.

Based on the results the following quantity of water can be recommended by making block

on months, which are closer in evaporation values.

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