Scheduling Irrigation for Arecanut with Pan-Evaporimeter

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Abstract

Studies were conducted over a period of four years for scheduling irrigation in arecanut based on Cumulative Pan Evaporation (CPE). The levels of irrigation to CPE used were (1) 30mm irrigation for 30mm evaporation, (2) 30mm irrigation for 60mm evaporation, (3) 60mm irrigation for 60mm evaporation and (4) 60mm irrigation for 120mm evaporation. The field trial was laid out at CPCRI Regional Station, Vittal conforming to strip plot design with above four irrigation treatments with three depths of planting of arecanut at 30, 60 and 90cm and five replications. Significant effect on the yield of arecanut was recorded with 30mm irrigation for 30mm evaporation and this was found to be better in terms of economic returns than the other schedules. Under circumstances when water supply and energy become critical, scheduling irrigation with 30mm water for 60mm CPE was also found to be beneficial.

Introduction

Irrigation is an important component in the management of arecanut in areas where monsoon is only seasonal. In Dakshina Kannada District of Karnataka where arecanut is cultivated extensively,there is a need to irrigate the crop during the dry weather period extending from mid-November to May. Earlier studies conducted at CPCRI, Regional Station, Vittal have indicated that irrigation once in five days is optimal for higher yield of arecanut (Anonymous, 1972 and Khader et al., 1984). Additionally, planting seedlings at a depth of 90 cm was found to be better than planting at shallower depths (Sadanandan, 1973). More recent work on the irrigation scheduling for crop plants have shown that it is realistic to schedule irrigation based on evapotranspiration than on arbitrary approach depending on frequency and quantity of water applied. Keeping this in view, an experiment was initiated during the year 1974-'75 for scheduling irrigation in arecanut based on CPE. An attempt was also made to study the depth of planting arecanut by integrating three different depths of planting along with the irrigation schedules. The studies were conducted over a period of four years and the results obtained are presented in this paper.

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Materials and Methods

The experiment was laid out at CPCRI, Regional Station,Vittal during the year 1974 in an established eight year old arecanut plantation. The palms were initially planted with 3 depths of planting and were uniformly irrigated with 200 l of water every five days during December to May.

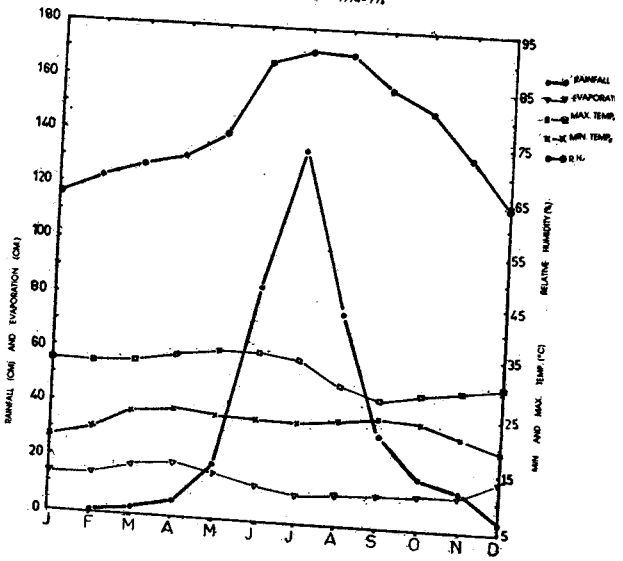
The irrigation treatments were superimposed on this by integrating the different depths of planting so as to obtain five replications for each treatment. There were four main irrigation treatments viz., (1) I_1-irrigation 30 mm when cumulative pan evaporation reaches 30 mm; (2) I_2–irrigation 30 mm when cumulative pan evaporation reaches 60 mm; (3) I_3–irrigation 60 mm when cumulative pan evaporation reaches 60mm and (4) I_4–irrigation 60 mm when cumulative pan evaporation reaches 120 mm.

The three depths of plantings were 30, 60 and 90 cm. For each treatment combination, 9 palms were available. The total plant population in the garden was 1200, out of which 540 palms were experimental. The remaining palms represent the border rows on all four sides of the plot. The palms were spaced 2.6×2.6 m apart. The layout conformed to a $4 \times 3 \times 5$ strip plot arrangement in RB design.

The irrigation was provided through surface conveyance and water was conveyed to the plots by using syphons from a main cement lined channel. 'U' shaped syphons of 1 m length and 5 cm diameter were used and 5 such syphons could discharge 30 mm water in 15 min.

The water evaporation was monitored using an open pan evaporimeter conforming to USWB class-A specifications. The irrigation scheduling was done as detailed above. The data on maximum and minimum temperature, relative humidity, evaporation rate and rainfall were collected (Fig. 1). Irrigation was provided from second half of November to the end of May each year. There was only occasional precipitation during the irrigation period which was accounted for while scheduling the irrigation.

FIG. 1 METEOROLOGICAL DATA DURING 1974-77.



The data on nut yield in terms of number and fresh weight were collected during each harvest and pooled to obtain year-wise yield. Statistical analysis was done on pooled yield data obtained over the four year experimental period.

The soil moisture content was determined by the gravimetric method of Piper (1950) under the different irrigation treatments from 0 – 90 cm depth just prior to each irrigation and on the day following irrigation.

Results and Discussion

The data on number and wet weight of nuts as affected by irrigation and depth of planting (Table 1), revealed that irrigation with 30 mm water when the CPE approached 30mm (I_1) was significantly superior

to I_3 and I_4, whereas it was on par with I_2. This clearly brings out that arecanut is fairly sensitive to moisture stress and requires irrigation to be provided at more frequent intervals.

Soil moisture content ranged between 19.5 to 21.4 per cent subsequent to irrigation and reduced considerably to about 12.1 per cent within a period of 5 to 10 days before the next irrigation in treatments I_1, I_2 and I_3 irrespective of the quantity of water used, while in I_4 the reduction (8.8%) in moisture content was even more prominent just before the next irrigation (Fig.2). Though the total quantity of water irrigated was the same for I_3 and I_1 treatments the frequency of irrigation in I_3 was only the half of that in I_1 resulting in wide fluctuations in soil water and a longer period of moisture stress thereby resulting in decreased nut yield. Such an effect of moisture stress on yield of crops has been observed by Bresler (1977).

FIG. 2 SOIL MOISTURE CONTENT UNDER DIFFERENT DEPTHS OF IRRIGATION

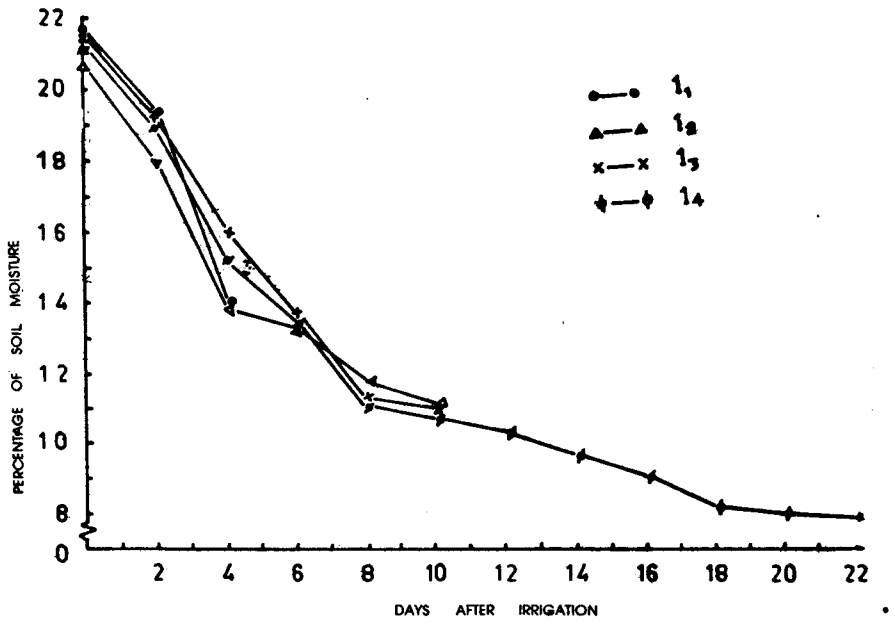


Table 1. Effect of irrigation and depths of planting on the number of nuts and weight of ripe nuts / palm

Irrigation treatments	No. of nuts / palm Depth of planting				Weight of ripe nuts (kg)/palm Depth of Planting			
	30cm	60cm	90cm	Mean	30cm	60cm	90cm	Mean
I_1	248.38	229.55	267.11	248.34	8.59	8.60	9.56	8.91
I_2	184.48	119.57	243.13	209.06	6.64	7.31	8.03	7.32
I_3	147.97	221.43	195.39	188.26	4.93	7.92	7.92	6.71
I_4	129.42	116.73	120.11	122.08	4.50	4.03	4.30	4.27
Mean	177.56	191.82	206.43	—	6.16	6.96	7.29	6.80
CD for Irrigation (P=0.05)	—	—	—	50.92	—	—	—	1.74

Though in the treatments I_2 and I_3 the frequency of irrigation was the same, I_2 had received only half the quantity of water than that of I_3. Here, again the differences in the nut yield were not significant showing that reducing the frequency of irrigation by increasing the quantum of water applied is not beneficial as the excess water supplied is not advantageous for plant use.

Economics of irrigation scheduling worked out based on the yield, volume of water required, frequency of irrigation and the cost of irrigation (Table 2), revealed that the monetary return with I_1 was Rs. 13,000 with 34 irrigations and an application of 1020 mm of water. When only 17 irrigations were given with 510 mm of water applied, the monetary return was Rs. 10,072 (I_2). These results have clearly demonstrated that the best irrigation schedule is 30 mm water when CPE approaches 30 mm. But under situations of limitations of water and energy supply, the scheduling can be extended at 30 mm water when CPE reaches 60 mm (I_2), minimising water and energy use.

Table 2. Economics of irrigation treatments in arecanut

Treatments	No. of irrigations	Total depth of water applied during the season (mm)	Yield (kg / ha)	Value of produce @ Rs. 8/kg (Rs/ha)	Labour engaged (man days)	Cost of labour @ Rs 8/day (Rs / ha)	Total cost of cultivation (Rs / ha)	Profit (Rs / ha)
I_1	34	1020	2545	20360	170	1360	7360	13000
I_2	17	510	2094	16752	85	680	6680	10072
I_3	17	1020	1922	15376	90	720	6720	8656
I_4	8	480	1221	9768	48	384	6384	3365

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Discussions

P M Gowda:

The net return from treatment I_2 may be worked out by considering the cost of providing additional 510 mm. I feel that the deep planting (90cm) with I_2 might be as efficient as I_1 at other depths. Examination of data of net returns due to interactions may be worthwhile.

N Yadu Kumar:

There was no response to depths of planting after a period of 5 years.

P Rethinam:

The experiment was continued from the earlier irrigation experiment wherein the yield potential under different treatments are highly varying. The same treatment effect will continue if the yield is recorded from 1975-'78. The pretreatment yield variance in different treatments are already very high due to previous experiment effect.

N Yadu Kumar:

Pretreatment data were taken into consideration before conclusions were drawn.

S Bhagavan:

Covariance analysis may be attempted to nullify the effect of superimposition of the treatments.