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IRRIGATION MANAGEMENT ON YIELD STABILIZATION AND ANNUAL PRODUCTIVITY OF COCONUT

Jose Mathew, G. R. Pillai, G. Santhakumari and Kuruvilla Varughese
Agronomic Research Station, Chalakudy 680 307, Kerala. India

Abstract : The impact of irrigation water management, with the treatments linked to climatic parameters, in coconut on inter-harvest yield variation and annual productivity was studied in a five-year field experiment. Yields got stabilized with adequate irrigation showing minimum fluctuation among harvests during different periods of the year. The data on per cent contribution of individual harvests, standard deviation, yield range between harvests and coefficient of variation clearly supported this argument. Based on yield trends and irrigation water consumption, irrigation at 50 mm CPE with 50 mm water was suggested as the best schedule for irrigating coconut during dry spell.

Key **words:** Coconut, inter-harvest yield variation, irrigation, seasonal yield stabilization.

INTRODUCTION

The price of coconut has been showing wide fluctuations during different periods of the year and this, at many a times, drastically brings down the income of the farmer. The large variation in the production of nuts among different harvests in an year is a major contributory factor for the instability in the market. Being mostly rainfed, moisture deficit during different periods of the year is mainly responsible for such non-uniformity in production. The influence of irrigation management on inter-harvest yield variation and per palm productivity was studied in this background.

MATERIALS AND METHODS

The trial was conducted at Chalakudy for five years in a 10 year old coconut plantation of West Coast Tall. The upper soil layer (0-45 cm) was sandy clay loam and the lower layer (60-90 cm) clayey. The wilting point and field capacity for 0-20 cm layer were 8.7% and 17.7% respectively and the corresponding values for 20-40 cm layer were 9.2 and 20.8%.

The different irrigation schedules were formulated based on climatological approach. Irrigations with 50 mm water at 75, 50 and 25 mm cumulative pan evaporation (CPE) were compared with the farmers' irrigation practice (irrigating once in three days with 20 mm water) and rainfed control. Basin size was 1.2 m and water measurement was done with circular orifice.

The experiment was laid out in randomised block design with four replications. The pre-treatment yield data of experimental palms were initially collected and were utilized for the lay out of the trial as well for the analysis of results. Irrigation treatments were imposed during dry period occurring between south west and north east monsoon.

RESULTS AND DISCUSSION

Annual productivity

The palms failed to respond to irrigation during the first two years (called the transit phase) of treatment imposition (Table 1). The period of development of an inflorescence from initiation to flowering has been estimated to be 32 months in tall cultivars of coconut (Nair *et al.*, 1988). Irrigation has only limited influence on the number of nuts, once the inflorescence is in the advanced stages of development. Rao (1989) also reported that the nuts obtained from the inflorescence which has been at the critical stages of initiation of spadix primordia and early phases of kernel formation at the time dry spell of the year extending from 27 to 34 meteorological weeks are the worse hit. This may be the reason for the failure of irrigation treatment in influenc-

Table 1. Irrigation management on per palm productivity (No. of nuts per palm) and irrigation water use

Treatments	Pre-treatment period	*Treatment period		Irrigation water use, mm
		Transit phase	Influence phase	
75 mm CPE	63.1	57.4	100.1	363
50 mm CPE	67.3	62.2	113.4	538
25 mm CPE	61.1	53.4	124.6	1038
Farmers' practice	65.1	55.6	128.3	795
Rainfed	59.2	56.3	86.5	-
CD (0.05)	NS	NS	18.4	-

*Transit phase = Mean of first and second years
Influence phase = Meat] of third and fourth years

ing the per palm productivity during the first two years.

The irrigation schedules exerted significant influence on the yield of nuts during the third and fourth years (called the influence phase). The yield obtained from farmers' practice was comparable with the schedules receiving wetting at 25 and 50 mm CPE. As compared to the aforesaid treatments, the yield reduction in unirrigated palms ranged from 24 to 33%. Irrigation at 50 mm CPE consumed the least quantity of irrigation among the top yielding treatments (Table 1) and hence was identified as the recommendable irrigation schedule for high nut production with minimum irrigation water use.

Share of individual harvests

While analysing the contribution of individual harvests towards annual palm productivity (Table 2), it was observed that the share varied from 10 to 16% in well irrigated treatments, with a range value of 6%. In the unirrigated treatment, the contribution varied from 7 to 19%. While the cumulative contribution of fifth, sixth, seventh and eighth harvests towards total yield in unirrigated treatment

Table 2. Irrigation management on contribution (per cent) of individual harvests towards annual productivity during influence phase

Harvest No.	Treatments				
	75 mm CPE	50 mm CPE	25 mm CPE	Fanners' practice	Rain-fed
1	13	12	14	12	12
2	16	14	11	16	19
3	18	14	15	15	19
4	13	13	14	13	13
5	9	10	11	10	8
6	8	10	11	10	7
1	11	13	12	11	11
8	12	14	12	13	11

was only 37%, the same harvests contributed 44 to 47% in well irrigated treatments. The data thus show the influence of adequate moisture supply during dry season in improving the yield of nuts during lean season.

The standard deviation (Table 3) of individual harvests from the mean yield indicated lower values in best irrigated treatments in spite of higher mean yields, manifesting a lower range of deviation. The standard deviation values for different years showed wide fluctuation in unirrigated and under irrigated treatments whereas it was more or less stable in well irrigated treatments particularly during the influence phase.

Range and coefficient of variation

A perusal of the inter-harvest yield data (Table 4) gave a quantified estimate of the extent of instability in nut production during different periods of the year. The data for the third and fourth years, as compared to the previous years, indicated tremendous improvement in the minimum values of production for individual harvests. The production was relatively very poor in under irrigated and unirrigated treatments during lean season.

Table 3. Influence of irrigation management on mean yield of individual harvests and standard deviation

Treatments	Mean yield of nuts per harvest (x *L* SD)				
	Pre-treatment year	Treatment years			
		1 year	II year	III year	IV year
75 mm CPE	7.9 ± 5.8	9.2 ± 5.7	5.1 ± 2.7	13.0 ± 7.3	12.0 ± 3.7
50 mm CPE	8.4 * 5.5	10.6 ± 7.7	5.0 ± 3.4	14.1 ± 3.3	14.2 ± 3.4
25 mm CPE	7.6 t 6.5	8.4 ± 5.4	5.0 ± 3.2	16.2 ± 4.0	14.9t 3.5
Fanners' practice	8.1 *i* 5.8	8.7 i 5.3	5.2 ± 3.5	15.6 T 5.8	16.5 ± 5.0
Rainfed	7.4 i 5.8	10.1 i 8.1	4.0 ± 2.6	12.0 ± 7.1	9.6 ± 3.9

x = Mean SD = Standard deviation

Table 4. Influence of irrigation management on range and coefficient of variation of individual harvests

Treatments	Range, No. of nuts per palm					Coefficient of variation, %				
	Pretreat-ment year	I year	II year	III year	IV year	Pretreat-ment year	I year	II year	III year	IV year
75 mm CPE	2.3-20.2	2.6-19.3	1.6-9.5	5.7-26.3	6,1-17.6	73.5	61.8	52.2	55.8	30.7
50 mm CPE	3 2-17 1	3 3-26 8	0.7-10 1	11 6-209	10.3-19.9	64.8	72.5	68,5	23.1	23,8
25 mm CPE	1.3-21.7	2.0-19.2	0.4-9.4	11.7-22.2	10.3-19.1	84.4	64.1	63.1	24.5	23.1
Farmers' practice	2.5-19.8	2.6-18.5	0.7-9.9	8.1-24.5	9.3-23.8	70.7	61.1	68	37.1	30.3
Rainfed	2.0-19.3	1.9-27.8	0.4-7.5	5.1-23.1	2.6-13.6	78.5	80.3	65.7	59	38.3

The stability in yield among the harvests was further assessed by working out the coefficient of variation (Table 4) which was found to be in the range of 70.7 to 84.4% during the pre-treatment year. It came down to 23.1 to 23.8% during the third and fourth years in the best irrigated treatments i.e., irrigation at 50 mm CPE. The coefficient of variation values were not only high but also were highly fluctuating in the unirrigated treatments during different years. The impact of irrigating coconut during dry spell on inter-harvest yield stabilization and on subsequent improvement in annual yield is very evident from the study.

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