[Reprinted from SCIENCE AND CULTURE
Vol. 41, pp. 381—383, August, 1975.]

A note on Saline Water Irrigation to Coconut Palm *Cocos nucifera* Linn. in Sandy Loam Soil

It is now well established that utility assessment of saline water irrigation to crops has to be done on the basis of salinity levels of irrigation waters, nature of soil and crop subjected to irrigation, climatic, particularly rainfall effect, and finally the overall crop response. The semihalophytic nature of coconut palm had been reported by previous workers[1-3]. Studies[4,5] on saline water irrigation to coconut in sandy soil conducted at Central Plantation Crops Research Institute, Kasaragod had shown that in summer months sea water irrigation was as beneficial as that with fresh water. A parallel observational trial[6] was conducted during 1958-1970 in sandy loam soil of this Institute to study the effect of irrigation with sea water (T_1), fresh water (T_2) and their mixtures in the ratio 2.5 : 1 (T_3) and 1 : 2.5 (T_4) as compared to no irrigation control (T_5) and in this note three important aspects of the experiment namely, (1) salinity levels of irrigation waters, (2) cumulative effect of irrigations on soil characteristics and (3) performance of palms are discussed.

A 5 × 4 randomised block design with uniformly manured single palm plots was adopted and irrigation was given during summer months (December-May) by pot watering at the rate of 45.1 of water per palm, per irrigation twice a week in shallow basins 9 cm deep and 150 cm radius formed round the palms It is contextual to mention that apart from its high sodium content, sea water contains fair amounts of essential bases (K—415 ppm ; Mg—1155 ppm ; Ca-429 ppm). Determinations such as *p*H (using *p*H meter), specific conductivity (using conductivity bridge) and total water soluble salts (gravimetrically) were made on fresh samples of irrigation waters and on composite soil samples drawn in the month of February 1970 (after 16 irrigations) from two depths : 0-15 cm ; and 15-23 cm from the basins of the palms. Data on irrigation waters and soil are given in the tables I and II respectively.

Table I. Salinity levels of irrigation waters used

Particulars of irrigation waters	*p*H	Specific conductivity μmhos/cm at 32.5°C.	Salt concentration (as NaCl in ppm)	Total water soluble salts (ppm)
Sea Water	7.8	57,600*	31,000	40,485
Fresh Water	6.5	62	24	115
Sea Water : Fresh Water (2.5 : 1)	7.8	44,640*	22,000	29,065
Sea Water : Fresh Water (1 : 2.5)	7.5	18,720*	8,750	11,790

* As measured without working dilutions.

Table II. Salinity levels of soil under experimental palms

(each figure is an average of 4 determinations on composite soil samples).

Treatments,	*p*H (1 : 2 soil : 0.01/M $CaCl_2$ suspension)		Specific conductivity (μmhos/cm at 32.5°C) (1 : 5 soil : water suspension)		Soil concentration (as NaCl in ppm) (1 : 5 soil : water suspension)		Total water soluble salts ppm	
cms	0—15	15—23	0—15	15—23	0—15	15—23	0—15	15—23
Sea Water T_1	4.9	4.6	2844.00	2628.00	1108.75	1020.00	8118.20	7499.50
Fresh Water T_2	4.3	4.0	48.24	52.56	21.75	21.00	1255.00	441.50
Sea Water : Fresh Water T_3 (2.5 : 1)	5.0	4.4	1980.00	1944.00	825.00	800.00	6084.40	6133.00
Sea Water : Fresh Water T_4 (1 : 2.5)	4.8	4.4	907.00	856.80	370.00	340.00	2929.90	2930.20
Control T_5 (No Irrigation)	4.2	4.3	36.72	54.72	17.50	24.00	508.75	645.00

These results show that sea water and its dilutions used were of very high salinity level according to the salinity categories of irrigation waters suggested and discussed by different workers[7–10] based on USSL classification.

The above results would reveal a rise in *p*H and considerable increase of specific conductivity, salt concentration, and total water soluble salts in the top layers of soil especially in the treatments T_1, T_3, T_4 as compared to T_2 and T_5. The increase is proportional to the salinity levels of irrigation waters used. A decrease of salinity is also noticed with depth. This trend was also observed in the studies made on soil layers (unpublished) from an area, subject to inundation with brackish waters during tidal action on the banks of Chandragiri river near Kasaragod, where the top layers had the highest salt concentration which steadily decreased with depth (upto 100 cm).

Sankaranarayanan *et al*[2] reported that coconut palms were found to grow without suffering any permanent physiological injury even in situations where their roots had come into contact with high salt concentration (upto 6380 ppm in soil) which was found to be lethal to crops like jack, cashew, mango etc. grown there. Krishnamurthy and Premanathan[11] stated that coconut palm can withstand salt concentration of 10,000 ppm. It is therefore evident that coconut has fairly high tolerance to salinity.

According to Moghe[9] very high (5000-8000 micromhos/cm) or excessively (above 8000 micromhos/cm) saline water can be made use of for irrigation without salinity hazard to highly salt tolerant crops in highly or exceptionally permeable soils with frequent irrigations. From the general performance of the experimental palms it is apparent that palms growing in sandy loam soil (coarse sand—77.32%; fine sand —2.76%; silt—2.2%; clay—16.32%) did not suffer salt injury eventhough excessively saline waters were used for summer irrigation for more than a decade. Although salinity build-up in the soil as a result of these irrigations was much pronounced, highly permeable nature of the soil with low water table, leaching effect of rains (annually 3500 mm of rainfall under West

Coast conditions) and high salt tolerant nature of the palm appear to be the favourable factors off-setting injurious effect of salinity on the palms. The results of the present study by and large adduce evidence to the observations of several workers reviewed by Lal[10]. Further there is a report[12] (Jacob Mathew, personal communication) stating that maximum response was observed in T_4 (an increase of 15.8 nuts over control). It would thus seem that there is an added advantage in employing sea-fresh water mixture in the ratio 1 : 2.5 probably arising out of the salts present in sea water.

We place on record our deep sense of gratitude to the late Mr. M. M. Krishna Marar, former Agronomist and Director who had initiated the irrigation trial. We warmly thank Dr. K. V. Ahamed Bavappa, Director for his keen interest and encouragement given in the preparation of this note. We are also thankful to Mr. N. G. Pillai, Soil Chemist for reading the manuscript critically.

M. NAGARAJAN
M. P. SANKARANARAYANAN
E. V. NELLIAT

Central Plantation Crops Research Inustitte, Kasaragod 670/24.

Received 24 *May* 1974.

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Pbliushed by Samarjit Kar, on behalf of the Indian Science News Association, 92, Acharya P. C. Road, Calcutta-9 and printed at Troika press, 204/1, B. T. Road, Calcutta- 35.