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EFFECT OF DRIP IRRIGATION AND MULCH ON SOIL AND PERFORMANCE OF DATE PALM UNDER SALINE WATER IRRIGATION

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ABSTRACT

Date palm cv 'Khadrawy' and 'Shamran' were irrigated with waters of EC 2.7, 6.0 and 9.0 dSm^{-1}. Salt accumulations in soil, considerably higher during irrigation phase in pre-monsoon period, were effectively leached by the seasonal rainfall in conjunction with runoff from microcatchment dur ng monsoon period. No carry over of salts was evident during five years of study. Drip irrigation was effect;ve in limiting the salt accumulation. Gravel mulch did not show any ameliorative effect in saline water irrigation.

INTRODUCTION

In arid regions of India, irrigation water is scarce and saline (Dhir, 1977). Date palm is considered to be highly salt tolerant but the information on its performance under saline irrigation water over long term is meagre. Therefore, a study on the effect of saline irrigation waters on salt accumulation and the effects of drip irrigation and mulch in modifying the effects of salinity in date palm was undertaken at the Central Arid Zone Research Institute, Regional Research Station, Pali.

MATERIAL AND METHODS

The experiment was conducted at the Central Arid Zone Reseaich Institute Regional Research Station, Pali, Rajasthan. The soil of experimental area was sandy clay loam, calciorthid with calcic horizon at 30 cm depth. Before planting of offshoots in the pits of 75 cm depth and 60 cm diameter were filled with surface soil [pH 7.6; EC (1:2) 0.2 dSm^{-1}; CEC 21.0 c mol (p^+) kg^{-1}; organic carbon 0.56%]. Moisture storage at field capacity for 75 cm depth in the pit was 160 mm.

Date palm (*Phoenix dactylifera* L) cv 'Khadrawy' and 'Shamran' were planted at 6 m x 4 m spacing in Feb 1978. A general provision for runoff to leach salts was made by so dividing the 6-m row space in three parts that 2-m wide central zone was flanked by 2 m of inward 4% slopy catchment on either side. Waters of 2.7, 6.0 and 9.0 dSm^{-1} EC with SAR 3.5, 20 and 27.3, respectively, were used for irrigation. Each

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year 15-18 irrigations were applied at 15-day intervals during March to June and at 20-day intervals during October to February @ 30.1 water/tree. Irrigations (drip irrigation and ring or basin) formed the main treatments and surface mulch by gravel (1.5-2 cm dia @ 10 kg per pit) as subtreatment. Each subtreatment comprised 3 plants with two replications. Normal schedule of fertilization and plant protection was followed.

Soil samples were drawn upto 60 cm depth each year from 1979 to 1983 at the end of rainy season (in September) and between October to June. The samples were analysed for salinity characteristics and ionic composition by the procedures described by Richards (1954). Growth performance (survival, height and suckering) of the palms were recorded.

RESULTS AND DISCUSSION

Salinity level of irrigated soils

Irrigation of date palm with saline water during 1978 to 1983 increased the salinity of soils upto 60 cm depth (Table 1) during irrigation phase from October to June. As a result of saline water irrigation, salt concentration in the root zone increased with increase in the EC of water. Salinity level of soil decreased during rainy reason as a result of leaching of salts by rain water in conjunction with runoff water from microcatchments. Ionic composition of salts also differed at the end of irrigation phase and leaching phase. As a result of leaching of salts, pH of the soil slightly increased. Soluble sodium and chlorides decreased with the leaching of salts. However, the level of soluble Ca+Mg was slightly higher after leaching of salts. Salt concentration in June (pre-monsoon, at the end of irrigation phase) was 4 to 6 times more than that in September (post-monsoon, after leaching phase). Cyclic changes in the salt concentration between irrigation and leaching phase under saline water irrigation for field crops and tree plantations has been reported by several researchers (Dhir, 1977; Jain, 1981; Jain et al., 1983) Runoff from micro catchments results in 120 to 150 per cent additional water (Jain and Singh, 1980; Singh et al., 1983). Runoff

Table 1. Effect of saline irrigation water on salinity characteristics of soils at pre and post mansoons seasons

Irrigation water (EC ds m^{-1})	Season	pH (1:2)	EC (1:2) (ds m^{-1})	Soluble ions (c mol kg^{-1})		
				Cl	Na	Ca + Mg
2 7	Pre-monsoon	7.55	1.07	1.83	1.70	0.65
	Post-monsoon	7 55	0 26	0.48	0.62	1.03
6.0	Pre-monsoon	7.55	1.33	2.32	2.61	0.64
	Post-monsoon	7.75	0.34	0.60	0.86	1.06
9.0	Pre-monsoon	7.67	1.64	3.51	2 35	0.85
	Post-monsoon	7.75	0.28	0.53	0.86	1.23

water, in conjunction with rain water, was sufficient to leach all the salts accummulated by saline water irrigation and no significant built up of salts was evident during the five years of study.

Irrigation and gravel mulch

During irrigation phase soil EC and concentratton of soluble of ions was considerably higher when irrigation water was applied by ring method in which basin around trunk was flooded than drip irrigation (Table 2). Differences between salinity of soils irrigated with drip and ring methods were non-significant after leaching of soluble salts during rainy season. With saline irrigation waters, drip irrigation seems very effective in limiting the accumulation of salts but where drainage is not a limitation, accumulated salts get effectively leached out by the seasonal rainfall in conjunction with the runoff from microcatchments. Total salt concentration in date palm root zone was slightly higher as a result of saline water irrigation when gravel mulch was applied. However, the differences were not significant after leaching of salts during rainy season. Thus gravel mulch did not show any ameliorative effects in the use of saline water for irrigation.

Table 2. Effect of drip irrigation and gravel mulch on salinity characteristics of soil at per- and post-monsoon stage

Treatment	Season	pH (1:2)	EC (dS m^{-1})	Soluble ions (c mol kg^{-1})		
				Cl	Na	Ca + Mg
A. Irrigation method						
Drip	Pre-monsoon	7.30	1.40	2.28	1.43	1.20
	Post-monsoon	7.67	0.38	0.45	0.38	0.78
Ring	Pre-monsoon	7 32	1.49	3.53	2.06	1.61
	Post-monsoon	7.63	0.32	0.73	0.37	0.85
B. Mulching						
Gravel mulch	Pre-monsoon	7.38	1.54	2.56	1.84	1.39
	Post-monsoon	7.56	0.33	0.45	0.40	0.78
Control	Pre-monsoon	7.37	1.22	1.86	1.71	1.24
	Post-monsoon	7.58	0.38	0.42	0.40	0.83

Performance of date palm plants

Pareek (1986) opined that waters of EC 3.5 to 5.3 dS m^{-1} could be used for date palm. In the present study, survival and growth of palm (Table 3) were not much affected by salinity in irrigation waters. The height of 'Shamran' palms was lower at EC 9.0 dS m^{-1} but these palms produced more number of offshoots as compared to 'Khadrawy palms. Irrigation by drip method resulted in higher survival of offshoots over the ring (basin) method in 'Khadrawy' but not in 'Shamran'

Table 3. Effect of salinity of irrigation water and irrigation method on survival and growth of date palm cultivars 'Shamran' (40 months after plantation) and 'Khadrawy' (46 months after plantation)

Treatment		'Shamran'			'Khadrawy'		
		Survival (%)	Height (cm)	No. of suckers/ palm	Survival (%)	Height (cm)	No. of suckers/ palm
Saline irrigation water EC (dSm^{-1})	2.7	62	190	2.0	75	118	2.8
	6.0	58	191	2 0	67	129	4.9
	9.0	71	170	2.5	75	144	2.9
Irrigation method							
	Drip	61	190	2.2	100	124	3.2
	Ring	67	178	2.1	44	136	3.7

cultivar. There was no difference in the time of flowering of the two cultivars owing either to irrigation EC or to irrigation method.

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