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Conservation of moisture through amendments under varying irrigation regimes on sugarcane (*Saccharum officinarum*)

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ABSTRACT

Two field trials were conducted during the main season of 1987–88 and 1988–89 to study the effect of different irrigation regimes, application of amendments, and their interaction on moisture conservation, cane growth and yield of sugarcane (*Saccharum officinarum* L.). Irrespective of irrigation regimes, basal incorporation of coirwaste at 25 tonnes/ha recorded higher cane yield of 134.3 tonnes/ha owing to more moisture-retentive capacity than other amendments. The cane yield was also higher in *jalashakti* treatment (124.6 tonnes/ha) than farmyard manure (114 tonnes/ha) and pressmud (119.9 tonnes/ha). Application of coirwaste and *jalashakti* in treatments where water was applied once in 19 days resulted in the net profits of Rs 21,674 and Rs 16,248 respectively.

In Tamil Nadu, out of the total sugarcane (*Saccharum* sp.) area of 0.22 million ha, more than 80% of the cane area is depending underground-water source for irrigation. A major area under sugarcane has to undergo a severe stress condition during February–June every year due to inadequate soil moisture because of hot summer and depletion of underground water source. Singh and Sanjiva Reddy (1980) stated that growth of cane, yield and juice quality are affected adversely when available soil moisture decreases from 60 to 20%. Parameswaran and Ramakrishnan (1988) reported that coirwaste improved soil moisture-retention capacity and helped to tide over the stress period in sugarcane. Sunder Singh (1990) reported similar results on the effect of coirwaste in sugarcane under varying irrigation levels. The present investigation was therefore, carried out to find an optimum irrigation regime in the combination of soil amendments and to workout the economics of different irrigation regimes and amendments.

MATERIALS AND METHODS

The field trials were conducted at the Sugarcane Research Station, TNAU, Cuddalore, during 1987–88 and 1988–89. The soil of the experimental field was sandy-loam. The soil was low in available nitrogen (186.0 kg/ha), medium in available phosphorus (18.0 kg/ha) and available potassium (169.0 kg/ha). The soil had organic matter 0.28%, pH 7.5 and electrical conductivity 0.30 mmhos/cm. The bulk density of the soil was 1.62 g/cm^3 and the infiltration rate 2.65 cm/hr. The treatments consisted of 24 combinations with 6 irrigation levels in main plots (I_1, recommended practice; I_2, IW : CPE ratio of 1.0; I_3, IW : CPE ratio of

Table 1. Water-use efficiency as affected by irrigation regime and amendments

Treatment	Cane yield (tonnes/ha)	Total water consumption (cm)	Water-use efficiency (kg/ha-cm)	Total number of irrigations	Interval between irrigation cycles (days)
Irrigation regime					
I_1, Recommended practice	136.8	228	600.0	38	10.0
I_2, 1.00 IW : CPE	135.2	216	626.1	36	10.0
I_3, 0.75 IW : CPE	119.9	162	740.0	27	13.0
I_4, 50% DASM	135.7	204	665.3	34	11.0
I_5, 75% DASM	119.6	152	786.7	26	14.0
I_6, Wilting point stage	93.2	115	811.0	19	19.0
Amendment					
A_1, Farmyard manure	114.0	179.5	646.6	30	13.0
A_2, Pressmud	119.9	179.5	681.7	30	13.0
A_3, Coirwaste	134.3	179.5	774.9	30	13.0
A_4, *Jalashakti*	125.3	179.5	716.4	30	13.0

0.75; I_4, irrigations at 50% depletion of available soil moisture; I_5, irrigations at 75% depletion of available soil moisture; and I_6, irrigations at wilting point), 4 amendments in subplots (A_1, farmyard manure 12.5 tonnes/ha; A_2, pressmud 25.0 tonnes/ha; A_3, coirwaste 25.0 tonnes/ha; and A_4, *jalashakti* 5.0 kg/ha). In each irrigation water of 6 cm was applied. The experiment was laid out in split-plot design with 3 replications. Recommended fertilizer schedule of 275 kg N, 62.5 kg P_2O_5 and 112.5 kg K_2O/ha was followed. All the quantity of phosphorus was applied basal in the form of superphosphate at the time of planting along the furrows. Nitrogen and potash were top dressed in the form of urea and muriate of potash in 3 equal splits at days 30, 60 and 90 days after planting. The drought-susceptible sugarcane cultivar 'CoC 671' was selected for the study. A seed rate of 150,000 two-budded setts/ha was used. All other cultural practices like weeding and manuring thrice on 30, 60 and 90 days, trashing twice on 150 and 210 days, propping on 210 days were followed as per recommendation

RESULTS AND DISCUSSION

Yield

Scheduling irrigations once in 10 days as per recommended practice recorded mean cane yield of 136.8 tonnes/ha. As the total water consumption was maximum with more number of irrigations under I_1 treatment, it established higher population and yielded more cane at harvest compared with all other irrigation regimes. A reduction of 12 and 24 cm of irrigation water under I_2 and I_4 treatments compared with I_1 did not affect the cane yield because of the sufficient moisture availability in the soil for optimum cane yield.

But widening the interval between 2 irrigations up to 14 days with the total of 24 irrigations significantly reduced the cane

Table 2. Effect of amendments and irrigation interaction on cane yield at harvest (tonnes/ha)

Amendments (sub) Irrigations (Mean)	I trial					II trial					Mean of 2 experiments			
	A_1	A_2	A_3	A_4	Mean	A_1	A_2	A_3	A_4	Mean	A_1	A_2	A_3	A_4
I1	133.2	138.4	149.8	141.6	140.7	126.8	129.8	141.5	133.6	132.9	130.0	134.1	145.6	137.6
I2	131.2	136.5	147.4	138.2	138.3	125.9	130.8	140.3	131.8	132.2	128.6	133.6	143.8	135.0
I3	108.2	117.2	129.8	122.5	119.4	109.5	115.8	131.5	124.8	120.4	108.9	116.5	130.6	123.6
I4	128.8	137.5	148.4	138.0	138.1	126.7	129.5	139.6	130.5	131.5	127.7	133.5	143.0	138.8
I5	107.9	116.8	128.5	121.4	118.6	108.5	116.7	131.9	125.3	120.6	108.2	116.7	130.2	123.3
I6	80.6	84.3	110.9	90.8	91.6	81.4	86.5	115.0	96.8	94.9	81.0	85.4	112.9	93.8
Mean	114.9	121.7	135.8	125.4		113.1	118.1	133.3	123.8		114.0	119.9	134.3	124.6

	I		II		Pooled analysis	
	SEd	CD	SEd	CD	SEd	CD
Irrigations (1)	1.12	2.87	1.03	2.65	0.72	1.85
Amendments (A)	0.94	2.19	0.76	2.41	0.56	1.79
I x A	2.39	5.09	2.86	6.09	1.37	2.93

yield undr I_3 and I_5 treatments compared with I_1 (Table 1). The early soil-water depletion due to lesser water application with wider intervals could have causd lesser yields under I_3 and I_5 treatments.

Insufficient moisture supply with severe stress condition due to wider interval of 19 days under I_6 treatment resulted in reduced cane yield of 93.2 tonnes/ha.

Pandian *et al.* (1989) reported that scheduling irrigation at 1.00 IW : CPE (once in 10 days) to sugarcane was the optimum and any ratio lower than this affected the yield. Prasada Rao *et al.*(1983) also found that prolonged water stress caused lower cane yields.

Application of amendments altered the cane yield significantly. Treatment A_3 recorded the highest cane yield. *Jalashakti* gave cane yield of 124.6 tonnes/ha, which was significantly higher than that with farmyard manure and pressmud.

Increased yield under A_3 treatment may be attributed to more moisture availability, optimum physical condition of the soil and improvement in the hydraulic conductivity. Due to reduction in bulk density, the loose and friable soil condition might have enabled better root spread and nutrient absorption resulting in better cane yields. Mayalagu *et al.* (1983) reported that coirwaste applied at 20 tonnes/ha recorded higher moisture content with improved hydraulic conductivity (Table 2).

Water-use efficiency

In 38 irrigations with 10-day interval the recommended irrigation regime (I_1) recorded 600 kg/ha-cm of water-use efficiency and 136.8 tonnes/ha of cane yield. Contrary to this water consumption was less (115 cm) under I_6 treatment resulting in higher water-use efficiency of 811.0 kg/ha-cm, in 19 irrigations. However, severe moisture stress in this treatment affected the cane yield by 43.6 tonnes/ha (Table 1).

Among amendments, coirwaste (A_3) application recorded higher water-use efficiency (774.9 kg/ha-cm).

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