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RESPONSE OF SUGARCANE TO DIFFERENT LEVELS OF IRRIGATION UNDER HIGH WATER TABLE CONDITIONS

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Field trial conducted during the year 1980—81 and 1981—82 at Regional Sugarcane Research Station, Navsari on heavy black soils under high water table conditions having treatments of three levels of irrigation schedule based on IW:CPE ratio of 0.5 (R_1), 0.7 (R_2) and 0.9 (R_3) during 1980—81 and four levels of irrigation scheduled at IW:CPE ratio of 0.3 (R_0), 0.5 (R_1), 0.7 (R_2) and 0.9 (R_3) during 1981—82, with four levels of nitrogen @ 100, 200, 300 and 400 kg N/ha. The results revealed not significant difference in the yield between the treatment R_1 (10 to 11 irrigations) and R_3 (16 to 17 irrigations) in both the years as well as in pooled analysis. Further, on lowering the irrigation schedule in second year at an IW:CPE ratio of 0.3 (R_0), the yield differences was not observed significant between the sixteen irrigation (R_3) and six irrigations (R_0) indicating the sugarcane crop does not only need more than ten irrigations. Under a situation of high water table conditions, but also there is a possibility to reduce the number of irrigation up to six each of 80mm depth

Economising irrigation water under perennial water supply system is equally important in sugarcane production as in other crops. It has been estimated about 250 tonnes (2.5 ha.cm) of water is required to produce one tonne of dry matter. The water requirement of sugarcane varies from place to place depending on the duration, vegetative development, soil type and climatic condition prevailing in the area. Joshi *et al.*, (1980) and Hapase *et al.*, (1981) estimated water requirement of sugarcane crop and they have concluded that generally the performance of this crop was observed to be good under the optimum moisture regime of 25 and 50 per cent depletion in available soil moisture, but on heavy black soils the depletion in available soil moisture in 0-30 cm depth did not showed significant difference in yield. Pao and Hung (1961) conducted an experiment at Puerto Rice and reported that significantly higher yield were obtained in 150cm depth compared to 50cm depth of water table

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conditions. Tippanavar and Reddy (1968) reported 25% saving in irrigation water under high water table condition in sandy loam soils at sugarcane Research Station, Mandya. Raul and Allison (1976) studied the effect of water table depth on the yield of sugarcane varieties and observed the different response of varieties to water table conditions. In view of this, it was thought necessary to study the influence of different levels of irrigations on sugarcane yield under high water table conditions at Regional Sugarcane Research farm, the present investigation was undertaken.

MATERIALS AND METHODS

Field experiment was conducted for two years (1980-81 and 1981-82) at Regional Sugarcane Research Station, Navsari on heavy black soils having high water table conditions. The farm received perennial irrigation water from Ukaikakrapar irrigation project and the water table of farm area fluctuates between 40 cm to 100 cm according to canal flow. The soils of the experimental plot is clayey having 62 to 68 per cent clay in 0-30 cm layer and the values of soil physical properties viz, field capacity, bulk density and permanent wilting point in 0-60 cm layer were 30.50%, 1.50 g/cc and 18%, respectively.

The experiment was laidout in split plot design with four replications. The gross and net plot size were 12.0m x 5.4m and 10.0m x 3.4m, respectively. The treatments included in the experiment were three levels of irrigation based on IW : CPE ratios of 0.5 (R_1), 0.7 (R_2) and 0.9 (R_3) in the year 1980-81 and four levels of irrigation at an IW : CPE ratios o 0.3 (R_0), 0.5 (R_1), 0.7 (R_2) and 0.9 (R_3) in the year 1981-82. Four levels of nitrogen viz., 100, 200, 300 and 400 kg N/ha were taken as sub-plo treatment. The intercepting drain wa opened to control the fluctuating water table and it was kept at 100 cm throughout the experimental period

Sugarcane crop variety CO. 6304 was planted in first week of January at 90 cm apart in both the years. Wet method of planting was followed, two common irrigations to all the treatment plots were given after planting to avoid adverse effect of crust formation and establishment of crop. The rest of the irrigations 80mm each as measured by water meter were applied as per the treatments based on IW : CPE ratios in both the years. The cumulative pan evaporation values were taken from USWB open pan evaporimeter installed in the meteorological observatory of the college farm. Nitrogeneous fertilizer was given in four splits. The first 15% of nitrogen alongwith the common dose of phosphorus and potash each of 125 kg/ha was given at the time of planting. The second dose of 30% nitrogen was given at the time of second common irrigation after planting. Thirs dose of 20% nitrogen

Table-1. Sugarcane yield (t/ha), number of irrigations, quantity of water applied and wateruse efficiency in different treatments of irrigations under high water table conditions

Treatment	Sugarcane yield (t/ha)			Number of irrigations			Quantity of water received(mm)			Wateruse efficiency t/ha/cm of water
IW : CPE ratios	1980-81	1981-82	Average	1980-81	1981-82	Average	1980-81	1981-82	Average	
R_0-0.3	—	91.51	91.51	—	6	6	—	480	480	1.91
R_1-0.5	110.20	101.54	105.87	11	10	10.5	880	800	840	1.26
R_2-0.7	110.87	105.10	108.07	14	13	13.5	1120	1040	1080	1.00
R_3-0.9	108.92	104.26	106.53	17	16	16.5	1360	1280	1320	0.83
SEm for R(t/ha)	2.22	3.95	1.86							
CD at 5%	NS	NS	NS							
CV %	11.41	22.21	16.81							

Table-2. Average available soil moisture in mm and percentage before each irrigation in the treatments of IW : CPE ratios (1980-81 and 1981-82)

Depth (mm)	Available moisture storage capacity (mm)	Average available soil moisture before each irrigation							
		mm				Percentage			
		R_0*	R_1	R_2	R_3	R_0*	R_1	R_2	R_3
0-30	53.28	4.33	7.12	10.32	12.24	8.13	13.36	19.37	22.67
30-60	55.12	23.52	35.46	38.16	40.16	42.67	64.33	69.23	72.86
60-90	55.37	49.00	50.69	51.08	51.19	88.50	91.55	92.25	92.45
Total	163.77	76.85	93.27	99.56	103.59				

NB : *Data for one year only.

was given nearly one month after second dose before respective irrigations as per treatment and the fourth dose of 35% nitrogen was given at the time of earthing up i. e. 109 days after planting and before onset of monsoon. The sugarcane crop was harvested at the age of 12months in both the years. The sugarcane yield data were recorded from each treatment plots and were statistically analysed.

RESULTS AND DISCUSSION

The data on sugarcane yield for the years 1980—81, 1981—82 and pooled given in table-1, revealed that the effect of the treatment of irrigation schedule based on IW:CPE ratio of 0.5 (R_1), 0.7 (R_2) and 0.9 (R_3) was not found to be significant in both the years as well as in pooled analysis. The average yield of sugarcane due to the treatments of R_1, R_2 and R_3 were 105.87, 108.07 and 106.53 t/ha. Treatment R_1 received 11 and 10 irrigations amounting to 880 and 800mm of irrigation water in the year 1980—81 and 1981—82, respectively. Similarly treatment R_2 received 14 and 13 irrigations in the year 1980—81 and 1981—82 amounting to 1120 and 1080mm, respectively, while treatment R_3 received 17 and 16 irrigations in the year 1980—81 and 1981—82 amounting to 1360 and 1280mm of irrigation water, respectively (Table—1.)

Amongst all these treatments of irrigations, treatment R_1 received the minimum number of average irrigations (10.5) consuming the lowest quantity (840mm) of irrigation water. It also produced the maximum water use efficiency of 1.20 t/ha-cm of water (Table-1) compared to R_2 (1.00 t/ha-cm of water) and R_3 (0.83 t/ha-cm of water). Hence the treatment R_1 was found to be optimum for scheduling irrigation to sugarcane crop under high water table conditions. This findings is not in accordance with the earlier findings of 14 irrigations amounting to 1120mm of irrigation water because it was for the normal soils for the same region reported by Joshi *et al.*, (1980). In all the optimum treatment R_1 received three to four irrigation less than the normal soil. This may be due to sufficient quantity of available soil moisture retained beyond 60cm depth before each irrigantion compared to that retained in 0-30cm depth in almost all the treatments of irrigation i. e. from wet (R_3) to dry (R_1) regime (Table-2). In otherwords the data showed that there was a possibility of reducing the depth of water at each irrigation under the condition of high water table. This may be ultimately increase the water use efficiency. The results are in agreement with the results resported by Tippanavar and Reddy (1968).

As the treatment effect was not found to be significant in first year of study (1980—81), in second year of the experiment, one more treatment of lower IW:CPE ratio of 0.3 (R_0) was included. The yield data, number of irrigation, quantity of water applied etc.

are also given in table-1 for R_0 treatment. The results indicated that the effect of IW:CPE ratios viz., R_0 (0.3), R_1 (0.5), R_2 (0 7) and R_3 (0.9) were not found to be significant. Looking to non-significant dfiference observed in the yield between the treatment R_3 (16 irrigations) and R_0 (six irrigations) in the second year of the study it can be seen that there is a further possibility of saving in total number as well as depth of irrigation water. In otherwords, the yield obtained by six and sixteen irrigations were at par.

From the above results, it can be concluded that under a situation of high water table at a depth of one metre, sugarcane crop does not only need more than ten irrigations, but also there is a possibility to reduce the number of irrigation upto six each of 80mm depth.

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