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RESEARCH ARTICLE

Influence of saline and sodic irrigation water on *Bajra-II* : Effect on concentration and uptake of nutrient

■ **A. Kamathker, K. B. Ranpariya and J. V. Polara**

SUMMARY

A pot experiment was conducted at Net House, Department of Agricultural Chemistry and Soil Science Junagadh Agricultural University, Junagadh to assess the different levels of saline and sodic irrigation water on content and uptake of nutrient by bajra during the summer-2020. The treatment consist of four levels for each of salinity (2, 4, 6 and 8 dS m^{-1}) and sodicity (5.0, 10.0, 15.0 and 20.0 SAR) of irrigation water on *Bajra* by adopting factorial CRD with three replications. The results indicated that application of different levels of saline and sodic irrigation water produced significant effect on concentration and uptake of N, P and K by grain and fodder of bajra crop.The highest N, P and K content (1.11%, 0.31% and 0.60 %) and uptake (225.5, 62.6 and 121.2 mg pot^{-1}) by grain and content (0.88 %, 0.21% and 0.33%) and uptake (976.0, 225.8 and 362.5 mg pot^{-1}) by fodder were observed with EC 2 dS m^{-1} level of salinity of irrigation water and the lowest content and uptake by grain were observed with EC 8 dS m^{-1} level of salinity of irrigation water, respectively. While the highest N, P and K content (1.15%, 0.30% and 0.59%) and uptake (256.9, 67.5 and 131.4 mg pot^{-1}) by grain and content (0.98%, 0.19% and 0.34%) and uptake (1072.7, 210.6, 370.2 mg pot^{-1}) by fodder were observed with SAR-5.0level of sodicity of irrigation water and the lowest content and uptake by grain were observed with SAR-20.0level of sodicityof irrigation water. The interaction effect between salinity and sodicity levels of irrigation water on uptake of N by grain and fodder where found significantly the highest with $C_1 \times S_1$(EC-2.0 dSm^{-1} ×SAR-5.0) level of salinity and sodicity of irrigation water.

Key Words : *Bajra,* Salinity, Sodicity, Content, Uptake of macronutrient

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Dwindling supplies of quality water for irrigation and competition from other users are forcing farmers to use saline water for irrigation.The use of saline waters for irrigation must be carefully performed because, when used to irrigate sensitive plants, these waters can cause significant reduction of growth. Inhibition of growth in plants under salinity occurs because of two reasons, the first one is related to the

osmotic effect caused by salinity, which reduces water absorption and nutrient uptake and the second one is due to the specific effect or the excess of the ions, which enter the transpiration flow and eventually cause damages to the leaves, reducing growth or negatively influencing the absorption of essential elements (Munns, 2005).

Saline stress is a complex phenomenon for plants, involving physiological alterations and affecting photosynthesis, which can be inhibited by the accumulation of $Na^+$and/or Cl^-ions in the chloroplasts (Taiz and Zeiger, 2013). The higher load of salt with increased level of salinity and sodicity of irrigation water restricted the root growth of plants that in turn reduced the uptake of nutrients leading to leaf chlorosis that reduces the photosynthetic potential of crops which ultimately leads to lower dry matter yield (Makarana *et al.*, 2019).

MATERIAL AND METHODS

The important physical and chemical characteristic of the soil under study and experimental techniques followed for the present investigation has been described in the first part of this paper (Kamathker *et al.,* 2021).

Chemical analysis for content and uptake of micronutrients by grain and fodder of *Bajra* were carried out by taking representative sample from each pot at harvest of crop.The samples were oven dried at 60°C for 24 hours and then powdered by using grinder and mixer.Finally, the powdered samples of grain and straw where utilised for estimation of N separately by micro Kjeldahl's method as described by Jackson (1973) while the P was determined by Vanado-molybdo phosphoric yellow colour method as described by Koeing and Johnson (1942) and K by flame photometer as described by Toth and Prince (1946) from triacid extract. The data recorded on various parameters are subjected to statistical analysis as per the procedure suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of levels of saline irrigation water on content and uptake of nutrient by *Bajra* :

The results showed that the major nutrient content and uptake by *Bajra* decreased with increasing salinity of irrigation water (Table 1). The highest N (1.11 and 0.88 %), P (0.31 and 0.21%) and K content (0.60 and 0.33 %) in grain and fodder, while the highest N (225.5 and 976.0 mg pot^{-1}), P (62.6 and 225.8 mg pot^{-1}) and K uptake (120.8 and 362.5 mg pot^{-1}) by grain and fodder of *Bajra*, respectively were observed with EC-2.0 dS m^{-1} level of saline irrigation water and the lowest values were observed with EC-8.0 dS m^{-1}level of saline irrigation

Table 1: Effect of levels of saline and sodic irrigation water on concentration (%) and uptake (mg pot^{-1}) of macronutrients by grain and fodder of *Bajra*

Treatments	Grain						Fodder					
	N		P		K		N		P		K	
	Conc.	Uptake	Conc.	Uptake	Conc.	Uptake	Conc.	Uptake	Conc.	Uptake	Conc.	Uptake
Salinity levels (C)												
C_1: 2.0 dS m^{-1}	1.11	225.5	0.31	62.6	0.60	120.8	0.88	976.0	0.21	225.8	0.33	362.5
C_2: 4.0 dS m^{-1}	0.97	175.0	0.28	50.6	0.56	98.8	0.80	834.8	0.18	181.4	0.30	308.1
C_3: 6.0 dS m^{-1}	0.90	126.6	0.23	32.8	0.54	71.9	0.73	762.4	0.16	171.6	0.29	301.2
C_4: 8.0 dS m^{-1}	0.83	91.4	0.17	19.7	0.48	50.2	0.66	658.3	0.13	131.1	0.33	242.2
S.E.±	0.02	3.26	0.004	1.54	0.01	2.36	0.02	23.89	0.001	4.69	0.01	6.26
C.D. (P=0.05)	0.05	9.41	0.01	4.43	0.02	6.80	0.05	68.86	0.001	13.51	0.02	18.04
Sodicity levels (S)												
S_1: 5.0 SAR	1.15	256.9	0.30	67.5	0.59	131.4	0.98	1072.7	0.19	210.6	0.34	370.2
S_2: 10 SAR	1.02	192.3	0.26	50.7	0.57	106.9	0.82	858.1	0.18	188.9	0.31	327.1
S_3: 15 SAR	0.88	116.9	0.23	32.2	0.54	70.1	0.7	716.5	0.16	169.9	0.27	278.2
S_4: 20 SAR	0.76	52.5	0.20	15.3	0.49	33.4	0.58	584.2	0.14	140.6	0.24	238.6
S.E.+	0.02	3.26	0.004	1.54	0.01	2.36	0.02	23.89	0.001	4.69	0.01	6.26
C.D. (P=0.05)	0.05	9.41	0.01	4.43	0.02	6.80	0.05	68.86	0.001	13.51	0.02	18.04
C x S Interaction												
S.E.±	0.03	6.53	0.01	3.08	0.01	4.72	0.03	47.78	0.001	9.37	0.01	12.52
C.D. (P=0.05)	NS	18.81	NS	NS	NS	NS	NS	137.72	NS	NS	NS	NS
C.V.%	5.63	7.31	5.82	12.86	4.51	9.56	7.47	10.24	5.94	9.15	7.66	7.14

NS= Non-significant

Table 2: Interaction effect between levels of saline and sodic irrigation water on nitrogen uptake (mg pot^{-1}) by grain

	C_1: 2.0 dS m^{-1}	C_2: 4.0 dS m^{-1}	C_3: 6.0 dS m^{-1}	C_4: 8.0 dS m^{-1}	Mean
S_1: 5.0 SAR	331.4	278.4	236.7	181.2	256.9
S_2: 10.0 SAR	272.0	214.8	152.7	129.8	192.3
S_3: 15.0 SAR	202.5	143.4	82.4	39.2	116.9
S_4: 20.0 SAR	96.3	63.5	34.7	15.5	52.5
Mean	225.5	175.0	126.6	91.4	
S.E.±	6.53		C.D. (P=0.05)	18.81	

Table 3: Interaction effect between levels of saline and sodic irrigation water on nitrogen uptake (mg pot^{-1}) by fodder

	C_1: 2.0 dS m^{-1}	C_2: 4.0 dS m^{-1}	C_3: 6.0 dS m^{-1}	C_4: 8.0 dS m^{-1}	Mean
S_1: 5.0 SAR	1332.9	1135.9	981.0	841.1	1072.7
S_2: 10.0 SAR	1043.7	932.5	802.4	654.0	858.1
S_3: 15.0 SAR	841.0	714.9	683.9	626.3	716.5
S_4: 20.0 SAR	686.6	555.7	582.4	511.9	584.2
Mean	976.0	834.8	762.4	658.3	
S.E.+	47.78		C.D. (P=0.05)	137.72	

water. The uptake of nitrate is known to compete with that of Cl, a major ion in saline soil (Mengel and Kirkby, 2001 and Abdelgadir *et al*., 2005). Similar findings were reported by Essa (2002) in soybean and Viradiya *et al.* (2008).

Effect of levels of sodic irrigation water on content and uptake of nutrient by Bajra:

Data presented in Table 1 indicated that the highest N (1.15 and 0.88 %), P (0.30 and 0.19 %)and K content (0.59 and 0.34 %) in grain and fodder, while the highest N (256.9 and 1072.7 mg pot^{-1}), P (67.5 and 210.6 mg pot^{-1}) and K uptake (131.4 and 370.2 mg pot^{-1}) by grain and fodder of *Bajra*, respectively were observed with SAR- 5.0 level of sodic irrigation water. While the lowest content and uptake of N, P and K of grain and fodder of bajra were observed with SAR- 20.0. Similar results were also observed by and Pathan *et al.* (2000) in cluster bean and Prasad *et al*. (2010) in lemongrass and concluded that increased Na^+ content in plant decreased the nutrient concentration and uptake by grain and straw of crop.

Interaction effect of saline and sodic irrigation water onnutrient content and uptake by *Bajra:*

The results on interaction effect of saline and sodic irrigation water on content and uptake of N, P and K by grain and fodder of *Bajra* were found non-significant except, N uptake by grain and fodder. The data with respect to N uptake by grain and fodder are presented in Table 2 and 3. The highest N uptake (331.4 and 1332.9 mg pot^{-1}) by grain and fodder were observed with EC- 2.0 dS m^{-1} × SAR- 5.0 and the lowest with EC- 8.0 dS m^{-1} × SAR- 20.0 level of irrigation water. Similar findings were also reported by Pathan *et al.* (2000) in cluster bean who concluded that increased salinity and sodicity of irrigation water decreased the N uptake by crop.

Conclusion :

From the present investigation it can be concluded that nutrient content and uptake of N, P and K by grain and fodder of *Bajra* decreased with increasing levels of salinity and sodicity of irrigation water. The highest content and uptake of nutrients by bajra were found when crop irrigated with water having salinity EC-2dS m^{-1} and sodicity SAR- 5.0.The combined effect of salineand sodic irrigation water were not found significant on content and uptake of N, P and K by grain and fodder of *Bajra* except, N uptake by grain and fodder.

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