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Short Communication

Quality of Irrigation Waters in Three Talukas of North Gujarat

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Lift irrigation has become the backbone of intensive agriculture in north Gujarat, particularly in Mehsana district. Crusting, poor germination and a decrease in productivity over the years in the region appear, to be related to the use of poor quality waters. As very little information is available on the quality of ground waters, the present study was taken up.

Tube well water samples were collected from Sidhpur (13), Visnagar (14) and Patan (26) Talukas of Mehsana district during the summer of 1988-89. The water samples were analysed for pH, Electrical conductivity, cations and anions as per standard procedures (Richards 1954). The soils of the talukas are sandy to sandy loam.

Electrical conductivity varied from 0.6 to 10.0 dS m^{-1} (Table 1). As per Indian Standards for sandy to sandy loam soils, permissible limit is 6 and 3 dS m^{-1} for well drained and ill drained soils Accordingly, 73.6 % of the samples are within the permissible limits.

The composition of tubewell waters revealed dominance of Na^+ among the cations in all the samples. The mean values of Na^+ were between

Table 1 *Characteristics of tubewell waters of three talukas in Mehsana district*

Characteristics	Sidhpur	Visnagar	Patan
EC (dS m^{-1})	0.6–3.9	1.5–3.6	0.7–10.0
	(1.6)	(2.4)	(3.8)
pH	8.0–9.1	8.4–9.8	8.0–9.1
Na^+ (meL^{-1})	8.0–36.0	12.8–36.0	8.2–60.0
	(18.4)	(25.5)	(31.2)
K^+ (meL^{-1})	0.01–0.06	0.01–0.48	0.01–0.12
	(0.03)	(0.08)	(0.06)
Ca^{2+} (meL^{-1})	0.6–4.0	1.0–7.2	0.6–4.4
	(2.0)	(2.0)	(2.1)
Mg^{2+} (meL^{-1})	0.8–5.0	1.0–9.8	0.4–14.6
	(2.4)	(3.2)	(4.5)
CO_3^{2-} (meL^{-1})	1.4–8.5	1.4–7.1	1.4–8.5
	(3.5)	(4.5)	(3.3)
HCO_3^- (meL^{-1})	4.3– 9.9	4.3–15.6	2.8–9.9
	(7.3)	(10.8)	(6.7)
Cl^- (meL^{-1})	4.0–28.0	6.0–22.0	5.0–54.0
	(11.2)	(13.9)	(26.0)
SO_4^{2-} (meL^{-1})	0.07–2.64	0.07–4.63	0.26–4.38
	(0.88)	(1.67)	(1.90)
SSP	6.77–87.2	49.1–90.1	59.1–94.2
	(80.3)	(83.0)	(82.2)
RSC (meL^{-1})	2.1–11.4	0.0–15.6	0.0–17.0
	(6.5)	(11.0)	(5.6)
SAR	5.8–19.8	5.6–25.3	5.5–33.6
	(12.6)	(17.2)	(18.2)

Numbers given in brackets are mean value.

Table 2 *Change in cation and anion concentration (meL^{-1}) in different electrical conductivity classes in irrigation waters*

Electrical condcutivity classes (dS m^{-1})	Concentration (meL^{-1})						
	Na^+	Ca^{2+}	Mg^{2+}	CO_3^{2-}	HCO_3^-	Cl-	SO_4^{2-}
Sidhpur							
0–2	15.5	1.8	1.9	3.5	6.7	8.4	0.76
2–4	28.0	2.7	3.8	3.3	9.4	20.7	1.26
Visnagar							
0–2	20.3	1.3	1.8	4.6	8.9	9.0	0.56
2–4	27.6	2.3	3.8	4.4	11.5	15.9	2.10
Patan							
0–2	16.3	1.6	2.2	3.8	7.3	7.7	1.52
2–4	27.6	1.8	3.6	2.8	6.8	21.7	1.49
4–6	46.2	2.5	6.3	3.5	7.1	42.7	2.06
6–8	45.0	4.4	3.2	4.3	4.3	41.0	2.82
8–10	43.0	2.9	11.8	3.6	3.6	47.0	4.20

18.4 and 31.2 as compared to 2.0 and 2.1 of Ca^{2+}, 2.4 and 4.5 of Mg^{2+} and 0.03 and 0.08 of me L^{-1} K^+. Waters are dominantly of Na -Mg -Ca type and accounted for 53.8, 84.6 and 100 % in Sidhpur, Patan and Visnagar talukas Whereas Na -Ca - Mg type contributed for 46.2 and 15.4 % in Sidhpur and Patan talukas. Similar observations were made by Jain (1979) for the ground waters in arid tract of Rajasthan. The mean values of cations generally increased with increased in EC class (Table 2) though there were exceptions at higher EC classes. Similar report was made by Narain *et al.* (1976). The EC values had a high correlation with Na^{2+} ($r = 0.831^{**}$) and Cl^+ ($r = 0.856^{**}$). All the samples of Sidhpur and 92 % each of Visnagar and Patan talukas had soluble sodium percentage (SSP) greater than 65 and thus undesirable for irrigation. Average concentration of Mg^{2+} was 1.2, 1.6 and 2.1 times greater than that of Ca^{2+} in tubewell waters of Sidhpur, Visnagar and Patan talukas and such waters are likely to have more adverse effects on soil properties as reported by Paliwal *et al.* (1975).

Amongst the anions, Cl has dominance over others. Concentration of Cl and SO_4 tended to increase in EC classes but the behaviour of CO_3 and HCO_3 was different. There was a significant correlation between EC and Cl ($r = 0.886$)

Sodium adsorption ratio (SAR) varied from 5.5 to 33.6. The SAR values had a high correlation with Na^+ concentration ($r = 0.746^{**}$). According to USSL classification (Richards 1954), 7, 32, 13 and 1 samples were of S_1, S_2, S_3 and S_4 sodicity classes. Thus S_2 and S_3 classes accounted for 85 % of the samples.

Residual sodium carbonate (RSC) concentration in 79 % of the samples exceeded 2.5 me L^{-1} and can be rated unsuitable. The percentage was 92, 90 and 50 for Sidhpur, Visnagar and Patan talukas. The RSC had a high correlation with CO_3 ($r = 0.640^{**}$), HCO_3 ($r = 0.778^{**}$) and CO_3 + HCO_3 ($r = 0.861^{**}$) contents.

Thus, results revealed a high salinity hazard but permissible for sandy soils. The SSP and RSC were high and reported to have quicker adverse effect on light textured soils than heavier textured soils (Manchanda *et al.* 1989). Hence indiscriminate and excess use of these sodic waters is required to be avoided.

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