

## RESEARCH NOTES

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### Extent and Inter-relationship of various Water Quality Characteristics in Under Ground Irrigation Waters

The water samples are received in the laboratories in huge number for recommendations, generally before sowing of seasonal crops. Disposal of such large number of samples becomes difficult within available short duration under meagre laboratory facilities. One easier way to overcome this difficulty may be to find out a single character determined in quick way and the same is highly correlated with other factors which determine the quality of water. The present study was, therefore, undertaken to develop inter-relationships between various water quality characteristics for future quantitative predictions and proper assessment of waters with limited resources and time.

In all 220 under ground irrigation waters from wells and tube wells were collected randomly from fourteen development blocks of Farrukhabad district of Uttar Pradesh in the months December and January during the rabi season of 1979-80. The water samples were analysed for various constituents following methods of USDA Hand Book No. 60. (Richards, 1954).

An average and variation in chemical composition of 220 water samples are given in Table 1. The EC of waters ranged from 0.29 to 4.60 mmhos/cm with an average value of 0.79 mmhos/cm. Out of 220 water samples 70.25,

26.85 and 2.90 per cent fell in  $C_2$ ,  $C_3$  and  $C_4$  classes respectively as per USSL classification system. Regarding Ayers (1976) classification, most of the waters were in safe category. The pH values ranged from 7.9 to 9.2 with an average value of 8.9. The soluble sodium per centage (SSP) varied from 4.47 to 95.0 with an average value of 49.87. Only 13.5 per cent waters showed their unfitness for use with respect to SSP, as they possessed values more than 70.0. The values of SAR ranged from 0.2 to 20.9 with an average value of 3.4. Out of 220 water samples 91.3 per cent fell in low sodium hazard ( $<10$  SAR) category. An average adj. SAR for the district was 7.28. Overall 58.6 per cent samples possessed adj. SAR values less than 6, 18.45 per cent between 6 to 9 and 22.95 per cent more than 9. About 92 per cent water samples had RSC values up to 2.5 me/l only. The concentration of boron ranged from traces to 7.8 ppm with an average value of 0.52 ppm. About 90 per cent samples contain boron upto 1 ppm only. The fluoride content varied from traces to 4.43 ppm with an average value of 0.75 ppm. Overall 64.6 per cent occupied low fluoride ( $<1$  ppm) category.

A number of correlations between various characteristics of waters were worked out and the same are presented in Table 2. All the cations and anion



significantly correlated with EC of waters as per findings of Mondal and Jain (1966) and Singh and Narain (1979). A highly significant correlation was observed between EC and SAR of waters as earlier reported by Mondal and Jain (1966), Jain (1979) and Singh and Narain (1979). There were significant correlations between EC and adj. SAR, EC and RSC, SAR and adj. SAR, SAR and Boron, adj. SAR and fluoride, adj. SAR and RSC, Na and B and Na and F. There was significant correlation between EC and boron as also reported by Nathani *et al.* (1966), Gajbhiye *et al.* (1973) and Singh and Narain (1979). There was significant correlation between EC and fluoride content of waters which was also observed by Singh and Sinsinwar (1975). pH of waters significantly correlated with boron, fluoride, SAR and RSC of waters. Singh and Narain also recorded significant correlations of pH with fluoride and RSC of waters. For prediction purposes, regression equations have also been developed, which may serve the purpose of proper water quality evaluation even by analysing few chemical constituents.

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TABLE 1. Average chemical composition of underground irrigation waters (total 220 samples)

Characteristics	Range		Average
EC (mmhos/cm)	0.29	- 4.60	0.79
pH	7.9	- 9.2	8.9
Cations (me/l)			
Na+	0.22	- 25.92	4.01
Ca++	0.20	- 9.60	1.66
Mg++	0.20	- 10.40	1.46
K+	traces	- 1.19	0.25
Anions(me/l)			
CO <sub>3</sub> --	-	2.80	0.73
HCO <sub>3</sub> --	0.80	- 20.40	3.43
Cl-	0.20	- 25.40	2.06
SO <sub>4</sub> --	traces	- 17.00	1.68
SSP	4.47	- 95.00	49.87
SAR	0.20	- 20.9	3.4
Adj. SAR	0.36	- 33.55	7.28
RSC(me/l)	-15.80	- +15.40	1.04
Boron (ppm)	traces	- 7.8	0.52
Fluoride (ppm)	traces	- 4.43	0.75

RT's signature



waters (total 220 samples)

TABLE 2. Correlations and regression equations of various characteristics of under ground irrigation waters (Total 220 samples).

Average	Characteristic (X Vs Y)	Correlation (r)	Regression equation
0.79	EC Vs Na	0.8797***	$Y=0.3666+5.554X$
8.9	EC Vs Ca	0.7848***	$Y=0.1748+1.88X$
4.01	EC Vs Mg	0.7808***	$Y=0.2385+2.15X$
1.66	EC Vs K	0.1174***	$Y=0.17258+0.098X$
1.46	EC Vs $HCO_3$	0.4046***	$Y=2.1186+1.66X$
0.25	EC Vs Cl	0.7731***	$Y=0.2547+2.93X$
0.73	EC Vs B	0.3182***	$Y=0.0939+0.59X$
3.43	EC Vs F	0.2282**	$Y=0.4735+0.35X$
2.06	EC Vs SAR	0.4809***	$Y=1.76+2.10X$
1.68	EC Vs Adj. SAR	0.7650***	$Y=1.75+8.12X$
49.87	EC Vs RSC	0.5214***	$Y=3036+8.4X$
3.4	pH Vs B	0.1804*	$Y=0.2291+0.44X$
7.28	pH Vs F	0.4766***	$Y=0.02056+0.097X$
1.04	pH Vs SAR	0.3345***	$Y=1.9812+3.41X$
0.52	pH Vs RSC	0.2399**	$Y=0.582+0.16X$
0.75	SAR Vs B	0.1967**	$Y=0.27356+0.084X$
	SAR Vs F	0.2370**	$Y=0.3067+0.13X$
	SAR Vs Adj. SAR	0.8145***	$Y=0.4941+1.99X$
	Adj. SAR Vs B	0.2277**	$Y=0.2688+0.4X$
	SAR Vs F	0.2335**	$Y=0.5024+0.034X$
	s B	0.2637**	$Y=0.2472+0.078X$
	s F	0.2592**	$Y=0.4933+0.069X$

\* Significant at 5%

\*\* Significant at 1%

\*\*\* Significant at 0.1%