Assessment of Irrigation water Quality

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Abstract: In the present study agricultural irrigation water sample were analysed to evaluate its physicochemical profile. Normally farmers get the soil quality tasted for selection of crops but the irrigation water quality is rarely tasted. Present study was undertaken in village Viramgaon , Tal. Khultabad, Dist. Aurangabad. Selection of samples done randomly from different gut numbers of total farm area. Ten Bore well samples were taken for the study and analysed for physical and chemical parameters like pH, Salinity, Na, Ca, Mg, Co_3 , HCo_3 ,Cl, So_4, Sodium Absorption ratio and Residual sodium carbonate using standard methods prescribed by APHA . The obtain values were compared with the standard limits of CPCB and FAO. The salinity is high than the prescribed standards which may leads to physiological drought condition.

Key words: Irrigation, Ground water quality, Sodium absorption ratio.

Introduction:

The area under case study falls in arid zone of Marathwada which is also drought prone. The farming in this area has largely depend on artificial irrigation using either surface water or ground water. Excessive use of fertilizers, discharge of untreated urban and industrial effluent in rivers and land deteriorates the ground water quality (M. Roychoudhari.et al, 2014). The quality evaluation of the irrigation water therefore is very important for the sustainable agriculture of this area, especially so if it is a ground water resource (Bore well) used for irrigation. The quality of irrigation water used not only is important from the crop growth point of view but also for the fertility of the soil. In the present case study of quality evaluation of irrigation water undertaken by us mainly physic-chemical parameters of 10 agricultural bore well samples were undertaken.

Materials and Methods:

Ten different locations of agricultural lands from village Viramgaon, Tq. Khultabad Dist. Aurangabad were selected for the study. The Bore well water samples were collected from different Gut No. of respective farmer, in polythene bottles. The samples were analyzed for physical and chemical parameters like pH, salinity, Na, Ca, Mg, CO_3, HCO_3, Cl, SO_4, using standard methods prescribed by APHA (2012) and Patil P.N. et al, (2012). Sodium absorbtion ratio and Residual sodium carbonate were calculated by using Standard methods given by Food and agriculture organization UN (1984) (Ayers and West Cot, 1994). Experimental work was carried out in MIT (CARS) Aurangabad. The institute has certification by CPCB. The results obtain for these parameters were compared with standards given. Based on these comparisons, report was prepared to advice the local farmers regarding the suitability of the water for irrigation.

Results and Discussion:

PH: The lower value of pH may cause turbulence and corrosion, while the higher values may produce incrustation, sediment deposition. (Kalwale A. M.and Savale P. A., 2012) In the present study the pH value in all collected samples ranges from 7.40 – 8.07 which are within the prescribed limits.

Salinity: The salinity is increased due to the salts present in the soil, basically inorganic salts which are mostly from chemical fertilizers excessively used by farmers, from soil they become water soluble and percolate to ground water, hence increase the salinity of ground water. In this study salinity ranges from 1.68 to 3.48 µ/ Cm. High salinity results into physiological drought condition. (Guy fipps, 2003,). Out of 10 samples sample no. 3,4,7,8, and 10 show the amount of salinity to be extremely high and hence unsuitable for irrigation.

Sodium: In present study value of sodium ranges from 1.72 to 4.62 ml/ lit. Which is within the prescribed limits. These values are useful to calculate Sodium Absorption Ratio (SAR).

Calcium: It imparts the hardness to the water. In present study it ranges from 0.60 to 3.20 ml/lit. Is higher than the prescribed limits of FAO (Food and agriculture organization UN) (Ayers and West Cot, 1994).

Magnesium: it also imparts the hardness to the water it ranges from 3.8 ml/lit to 8.2 ml/lit. The values are shown higher in some of the samples.

Chloride: higher chloride ions indicates organic pollution in water. It may also increase due to sewage water mixing. It ranges from 4.00 to 18.00ml/lit. Which are higher than the prescribed limit.

Sodium Absorption Ratio: Irrigation water containing large amounts of sodium is of special concern due to sodium effects on the soil and poses a sodium hazard. Sodium hazard is usually expressed in terms of (SAR). Continuous use of water having a high SAR leads to a break down in the physical structure of the soil. Sodium is absorbed and become attached to soil particles. The soil become hard and compact, because of that water penetration rate become slow. It affects permeability of soil and causes infiltration problem.

SAR expresses the relative activity of sodium ions in exchange reaction with soil, it can be calculated using the formula

$$SAR = \frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$$

High sodium content soil reduces infiltration and lack of nutrients and oxygen capacity of soil. In this study it ranges from 0.96 to 2.41µeq / lit which is permissible limits of FAO. (Food and agriculture organization UN).
Residual Sodium Carbonate (RSC): It is calculated as

RSC= $(Co_3 + HCo_3) – (Ca^{2+} + Mg^{+2})$.
It is used for alkalinity hazard of soil. If RSC< 1.25 water is considered as safe and Water is not appropriate for irrigation. In this study RSC value is more in sample No. 8 and 10 than the standards.

Table -1 Physicochemical Analysis of Irrigation Water samples of survey area.

Sample no.	Gut No.	Parameters										
		pH	Salinity (mS/cm)	Na (me/l)	Ca (me/l)	Mg (me/l)	CO_3 (me/l)	HCO_3 (me/l)	Cl (me/l)	SO_4 (me/l)	Sodium absorption ratio (me/l)	Residual sodium carbonate (me/l)
1	62	7.95	1.99	3.46	0.60	7.80	1.60	6.40	6.00	0.00	1.69	0.00
2	60	7.99	2.06	3.72	1.60	6.00	2.40	6.60	4.00	0.00	1.91	1.40
3	164	7.74	2.54	4.37	2.40	7.60	2.00	9.20	14.00	0.00	1.95	1.20
4	103	7.61	2.70	3.41	2.80	8.20	2.40	8.00	12.80	0.00	1.46	0.00
5	182	8.07	1.68	1.72	2.60	3.80	2.00	6.00	10.00	0.00	0.96	1.60
6	66	7.90	1.72	3.51	2.00	5.60	2.80	5.20	14.00	0.00	1.80	0.40
7	155/3	7.48	3.48	4.62	3.20	7.80	2.80	8.40	18.00	0.00	1.97	0.20
8	61	7.44	2.50	4.31	2.40	4.00	3.20	6.80	12.00	0.00	2.41	3.60
9	20390	7.40	1.85	2.07	3.00	4.00	3.60	4.40	5.60	0.00	1.10	1.00
10	22	7.85	2.40	3.94	1.80	7.20	1.20	10.80	8.80	0.00	1.86	3.00
FAO Standards		6.0-8.5	0 - 2	0 - 40	0 - 20	0 – 5	0 - 1	0 - 10	0 - 30	0 - 20	3	0 - 1.25

Discussion and Conclusions:
Overall observations indicate all the 10 samples to be highly saline. Out of 10 samples, sample number 3, 4, 7, 8 and 10 show the amount of salinity to be extremely high and hence unsuitable for irrigation. Due to high salinity, these bore well water samples are going to adversely affect the soil productivity and crop growth in future. The present study can help in the selection of salinity tolerant crop varieties.

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