SUITABILITY OF WATER QUALITY FOR IRRIGATION. A CASE STUDY OF KONDAKARLA LAKE, ANDHRA PRADESH

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INTRODUCTION

Water quality refers to the degree of suitability for a specific purpose and it largely depends on the physico-chemical composition of its water. The suitability of water for irrigation purposes should therefore be assessed on the basis of its ability to create favourable conditions for crop growth. Irrigation water contains measurable quantities of dissolved salts originating from different sources. Eaton (1950), Szaboles and Daras (1968), Rhoades (1972), Sreerama Murthy *et al.,* (1995) are some of the attempts made on the water quality for irrigation in general.

Kondakarla Lake is situated at 50 km. south-west of Visakhapatnam in Andhra Pradesh and stretched between latitudes 17°35′30″ and 17°36′02″ N and longitudes 82°59′27″ and 83°01′0″ E. Though located at about 20 kms. away from the Bay of Bengal, the lake water is the main source of irrigation to the surrounding agricultural fields, where sugar cane is the major crop (75%) followed by paddy (15%) and vegetables (5%). This paper assumes significance due to its maiden attempt in analysing suitability of the water for irrigation.

MATERIAL AND METHODS

Water samples have been collected on 22.04.2000 from three sites of the lake where the crop density is much in its surroundings, *viz.,* Kondakarla village, Vadrepalle and Haripalem. These samples have been analysed for 13 parameters required for the study. The factors like Sodium Absorption Ratio (SAR), Residual Sodium Carbonate (RSC) and Percent Sodium (PS) have been calculated with the following formula :

$$SAR = Na \Big/ \sqrt{\left(\frac{Ca + Mg}{2}\right)}$$

$$RSC = (Co_3 + HCo_3) - (Ca + Mg)$$

$$PS = \frac{100\,Na}{Na + Ca + Mg + K}$$

RESULTS AND DISCUSSION

Results of the 13 parameters analysed together with its tolerance limits are given in Table I. Suitability of irrigation water depends primarily upon the silt and salt constituents. The total concentration of soluble salts, the proportion of sodium to other cations, bicarbonate concentration. and calcium with magnesium concentration are the important factors for assessing the suitability of water quality for irrigation.

pH : The water is found alkaline with pH value 8.5 at all the three spots of the water body. The tolerance limits of this factor is 6.0 to 8.5. Accordingly, this water is suitable for agricultural purposes.

Electric conductivity : This parameter ranged from 990 (Vadrepalle) to 1450 micro mhos/cm (Kondakarla Village). Waters below the level of 2,250 are found to be suitable for good crop growth with proper management and drainage conditions, but saline conditions may develop if leaching and drainage are inadequate. Irrigational water with electric conductivity between 750–2250 is classified as C3 water and accordingly Kondakarla lake water falls under this class.

Bicarbonates : Abnormal quantity of bicarbonates affects the uptake and metabolism of nutrients by plants and it varies in different species. Calcium and magnesium precipitate as carbonates in waters having more concentration of bicarbonates and also increase the exchangeable sodium percentage. Bicarbonates in the ecosystem was found from 3.6 to 5.2 m.eq/L.

Chloride : Abundance of chlorides may be toxic to fruit crops and injurious to leaves. Maximum tolerable limit of this factor is 17 m.eq/L. and this value in the ecosystem is found between 4–7. The rate of accumulation of this parameter in soil does not have any relation with its concentration in irrigating waters. Silty clay loams accumulate more chlorides in a given time than sandy loams and sands.

Sodicity : Concentration of sodium relative to other cations is called sodicity. Sodium, magnesium, chloride and sulphate are abundantly found in saline waters. Magnesium is one of the important criteria in determining the irrigational waters and high magnesium absorption affects the soil unfavourably. (Szaboles and Daras, 1968).

Table I. : Physico-chemical parameters of Kondakarla Lake.

Sl. No.	Parameters		Kondakarla Village	Haripalem Village	Vadrepalle Village	Tolerance limits (max.)
1.	pH		8.55	8.5	8.6	6.0–8.5
2.	Electric conductivity	(Micro mhos/cm)	1450	1320	990	2250
3.	Carbonates	(m.eq./L.)	0.8	0.6	1.0	–
4.	Bicarbonates	"	5.2	4.2	3.6	–
5.	(Calcium + Magnesium)	"	6.0	6.2	3.8	–
6.	Sodium	"	8.48	7.04	6.08	–
7.	Potassium	"	0.05	0.05	0.1	–
8.	Chloride	"	7.0	5.2	4.0	17
9.	Sulphate	"	1.4	2.8	1.0	21
10.	Nitrate	"	0.13	0.11	0.23	–
11.	Residual Sodium Carbonate	"	NIL	NIL	0.6	1.25
12.	Sodium Absorption Ratio	–	4.9	4.0	4.41	26
13.	Percent Sodium	–	58.36	52.97	60.92	60
14.	Water Quality	–	C_3S_1	C_3S_1	C_3S_1	–

m.eq = milli equivalents

The sodium hazard of irrigation waters is measured by the concentration of sodium to calcium and magnesium which is called Sodium Absorption Ratio (SAR). The SAR values in the present study floated from 4.0 to 4.9 and its tolerance limit is 26. The sodium hazard of irrigation waters as expressed by SAR does not take account the effect and anionic composition. The higher SAR values deteriorates the soil texture in irrigation waters. As per the Indian Standards (2296–1982) irrigation water with SAR less than 10 is classified as S_1 and accordingly Kondakarla lake water belongs to this class.

Residual Sodium Carbonate (RSC) during the survey was found 0.6 m.eq/lit. at Vadrepalle and absent in the other two places. According to Eaton (1950), waters with RSC greater than 2.5 m.eq/lit. may be regarded as deleterious while those with less than 1.25 m.eq/lit. are considered safe.

From the water samples the percent sodium ranged from 53 to 61 (rounded of to nearest fraction) and its maximum tolerance limit is 60.

Sulphates : Sensitivity of plants to high sulphate concentration is related to the tendency of high sulphate concentrations to limit the calcium uptake by plants.

The decrease in the uptake of the factor is associated with relative increases in the absorption of sodium and potassium. Sulphate quantity in the lake water during the survey ranged between 1.0 to 2.8 while its tolerance limit is 21.

CONCLUSION

The suitability of irrigation water has to be assessed on the basis of specific conditions like different agroclimatic conditions, different crops (sensitive, semitolerant, tolerant), its varieties and cultural practices. Due to differences in these conditions in different areas, one can treat the above guidelines for evaluating irrigation water quality.

As such the Kondakarla lake irrigation water has been classified as C_3S_1 on the basis of the electric conductivity (750–2250 micro mhos/cm) and SAR (less than 10). All the parameters of Kondakarla lake water are within the limits required for agricultural purpose and thus indicated its suitability for irrigation purposes.

SUMMARY

In order to assess the suitability of water quality for irrigation purposes at Kondakarla Lake which is forming one of the major wetlands in Visakhapatnam District of Andhra Pradesh, the author has collected its water samples and analysed the relevant parameters. The positive results obtained have been discussed in the light of its suitability.

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