

Irrigation Water Quality for Agriculture Purpose in Major Paddy Growing Areas of Nagapattinam Taluk in Nagapattinam District, Tamil Nadu – India.

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Abstract - This present study assess the irrigation water quality of major paddy growing area of Nagapattinam taluk of Nagapattinam District in Tamil Nadu and the influence of basic physico-chemical parameters on soil fertility. The water quality index SAR, RSC, Geo-chemical types, classification, suitability of water for irrigation purpose. A total Number of 54 Bore Well irrigation water samples were collected, which covers 18 revenue villages in Nagapattinam taluk by collecting 3 samples from each revenue village. Irrigation water samples are collected from agriculture bore wells in a clean plastic can of one liter capacity. The plastic cans are tagged individually with sufficient informations. The physico - chemical parameters such as pH, EC, TDS, Na⁺, K⁺, Ca²⁺, Mg²⁺, SO₄²⁻, NO₃²⁻, Cl⁻, CO₃²⁻, HCO₃⁻ and Geo chemical types are determined by following appropriate methodology and instruments like pH meter, Conductivity bridge, EDTA-Titrimetric, Flame emission photometric, Turbidimetric, Argentometric, Brucine Colorimetric, Titrimetric and by Gravimetric methods of analysis by standard methods and by using standard instruments. Then the irrigation water quality results are compared with standard values recommended by World Health Organization (WHO), Beauraw of Indian Standards (BIS) and Indian Council for Medical Research (ICMR). Hence an attempt has been made to evaluate the irrigation water quality. Based on the results, remedial measures are suggested to improve the quality of irrigation water and crop productivity. The proposed work is very essential not only for crop production but also to maintain soil fertility, to maintain hazardous free environment and to enhance the living standard and in turn to uplift our Agriculturist.

Keywords - Irrigation water, Nagapattinam taluk, Nagapattinam district, Tamil Nadu.

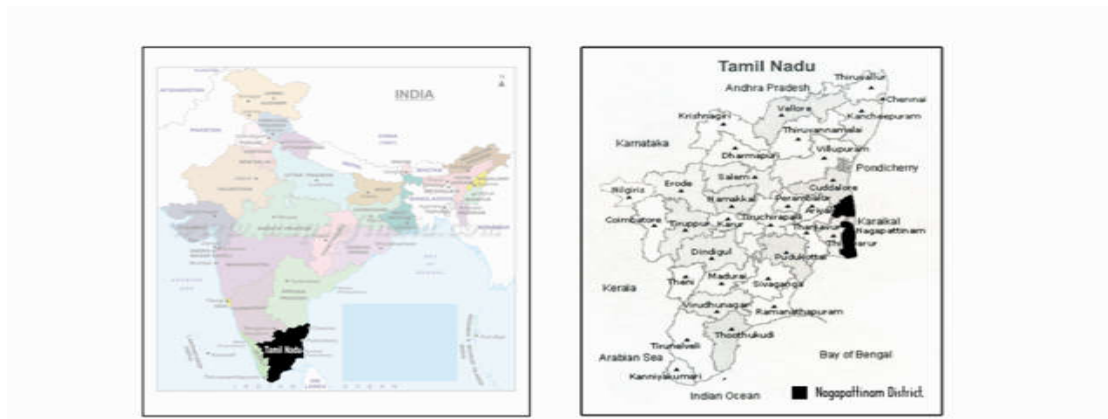
I. INTRODUCTION

The essential natural resources for agricultural are soil and water. Through efficient and careful management of these two natural resources to best advantage of crop growth, maintenance in view the environmental factors also, the agriculture production can be better. The concentration and composition of dissolved salts in water decides its suitability for irrigation, degradation of ground water quality of the aquifers causing sea water interference into the coastal aquifers^[1]. Water samples analyzed by standard methods^[2-6]. Total concentrations of soluble salts, relative quantity of sodium to other cations, concentrations of boron or other elements that can toxic to plants, and the bicarbonate concentration related to the concentration of calcium plus magnesium are important characteristics determining the quality of irrigation water. Salinity of irrigation water may limit the choice of crops that can be grown. The most influential water quality guideline on crop productivity is the water salinity hazard as measured by electrical conductivity.^[7]

II. STUDY AREA

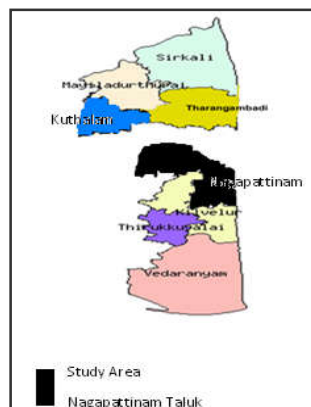
Nagapattinam taluk is one among the eight taluks of Nagapattinam district located adjacent to Kilvelur taluk in Tamil Nadu. The study area covers an extent of 30,231 ha land area with 85 numbers of revenue villages under Nagapattinam taluk. The location map of the Nagapattinam taluk is given in Fig. 1.

FIG. 1. LOCATION MAP



Tamilnadu

Nagapattinam District



Nagapattinam Taluk

III. MATERIALS AND METHODS

Irrigation water samples were collected randomly in a systematic manner covering major rice growing area in Nagapattinam taluk of Nagapattinam district. A total 54 samples were collected from bore wells in clean plastic cans of 1 lit capacity. The bottles are tagged individually for sufficient information similar to date, location, deepness of well. The results of the average mean value of irrigation water quality parameters are shown in Table 4. The percentage of irrigation water quality parameters are shown in Table 5.

Quality of irrigation water analyzed in the laboratory determined many parameters such as pH, EC, Ca, Na, K, SO₄, Cl, Mg, CO₃, and HCO₃ are determined by standard methods and by using standard instruments. Then the irrigation water quality results are compared with standard values Recommended by World Health Organization (WHO), Bureau of Indian Standards (BIS) and Indian Council for Medical Research (ICMR).

Important water quality ratings

Important water quality ratings that merit consideration are detailed below. These ratings could be used as guidelines when recommendations are given.

Electrical Conductivity (EC)

Electrical conductivity expressed in dsm⁻¹ represents the total salt content of irrigation water. The major anions are carbonates, bicarbonates, sulphate and chloride with low concentration of fluoride and nitrate. Standard water quality parameters were given table 1 to 3.

Class	E.C (dsm ⁻¹)	Salinity status	Suitability
C ₁	0.0-1.0	Low salinity water	Excellent
C ₂	1.01-2.0	Medium salinity water	Good
C ₃	2.01-4.0	Salinity water	Doubtful
C ₄	4.01-6.0	High salinity water	Injurious
C ₅	>6.0	Very high salinity water	Unsuitable

Table. 1 Classification of irrigation water based on Electrical Conductivity

Sodium Absorption Ratio (SAR)

The ratio of sodium contents to that of calcium and magnesium in the water is called Sodium Absorption Ratio. Sodium Absorption Ratio also denotes sodium hazard.

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

Class	SAR	Suitability
S1	< 10	Safe
S2	10.01-20.0	Moderate
S3	>20.0	Unsafe

Table. 2 Classification of irrigation water based on Sodium Absorption Ratio

Residual Sodium Carbonate (RSC)

Residual Sodium Carbonate indicates bicarbonate hazard. It is determined by the proportion of carbonate ions to that of calcium and magnesium ions

$$RSC \text{ (Meq/lit)} = (\text{CO}_3^{2+} + \text{HCO}_3^{2+}) - (\text{Ca}^{2+} + \text{Mg}^{2+})$$

The increased Residual Sodium Carbonate value leads to alkali formation because of the precipitation of calcium and magnesium carbonate/ bicarbonate or sodium and bicarbonate

Class	RSC (Meq/lit)	Suitability
R1	< 1.25	Safe
R2	1.26-2.50	Moderate
R3	>2.50	Unsafe

Table. 3 Classification of irrigation water based on Residual Sodium Carbonate

Geo chemical type

Calcium bicarbonate and calcium sulphate waters contain the lowest conductance. Sodium chloride water has the highest conductance. When calcium and magnesium more than half of the total cations it is considered calcium/ magnesium type. When sodium and potassium is more than half of the total cations, the water is considered sodium type, if bicarbonate, carbonate is than 50% of the total anions, it is considered bicarbonate type. The content of chloride plus sulphate exceeds 50% of the total anions it is considered chloride type. Problems associated with some Geo chemical types of water. Geo chemical type refers to predominate soluble salt present in the irrigation water. The wide Geo chemical types are chloride water, sulphate water, bicarbonate water. Associating with different cations, the Geo chemical type varies. Magnesium content is the important in determining the quality of irrigation water, sodium is another essential factor to study sodium hazard. The high percentage of sodium water stunts the plant growth, sodium react with soil to decrease its permeability^[8]. Sodium percent in water is a parameter computed to evaluate the suitability for irrigation^[9]. Excess sodium water develop the unwanted effects of changing soil properties and reducing soil permeability^[10], the irrigation water tends to enter into cation-exchange reactions in soil can be indicated by the sodium absorption ratio^[11]. The irrigation water status of Nagapattinam taluk were given figure 2 to 5.

Sl.No	NAME OF THE TALUK	pH	EC(ds m ⁻¹)	ANIONS (meq/lit)					CATIONS (meq/lit)					RSC	SAR	Type	Class
				CO ₃	HCO ₃	Cl	SO ₄	Total	Ca	Mg	Na	K	Total				
1	NAGAPATTINAM TALUK	7.31	0.89	0.57	5.54	8.32	0.52	14.42	3.92	4.51	5.54	0.27	14.23	1.30	2.87	NaCl	C ₂ S ₁ R ₁

Table 4. Average mean value of irrigation water quality parameters of nagapattinam taluk in nagapattinam district.

Sl.No	NAME OF THE TALUK	NaHCO ₃	MgHCO ₃	CaHCO ₃	NaCl	MgCl ₂	CaCl ₂	C1	C2	C3	S1	S2	S3	R1	R2	R3
1	NAGAPATTINAM TALUK	27.77	-	9.25	31.48	16.66	14.81	37.03	42.59	20.37	100	-	-	83.33	16.66	

Table 5. Percentage of irrigation water quality parameters of nagapattinam taluk of nagapattinam district.

IRRIGATION WATER STATUS OF NAGAPATTINAM TALUK

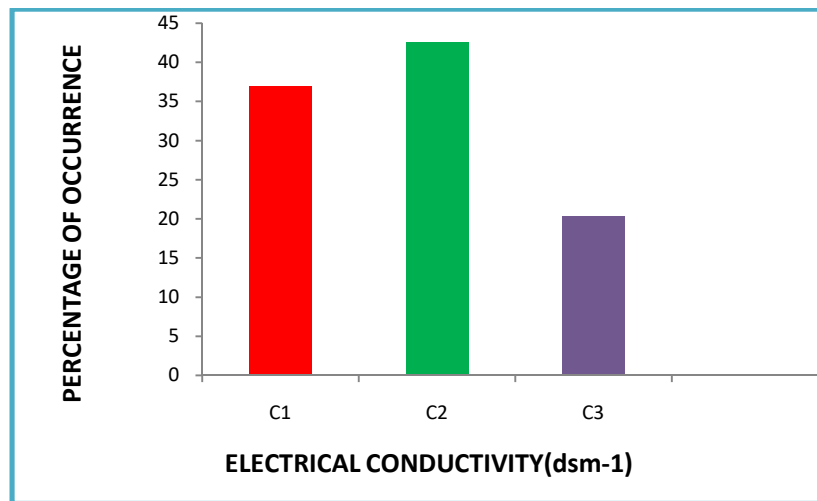


Fig. 2 Electrical conductivity rating

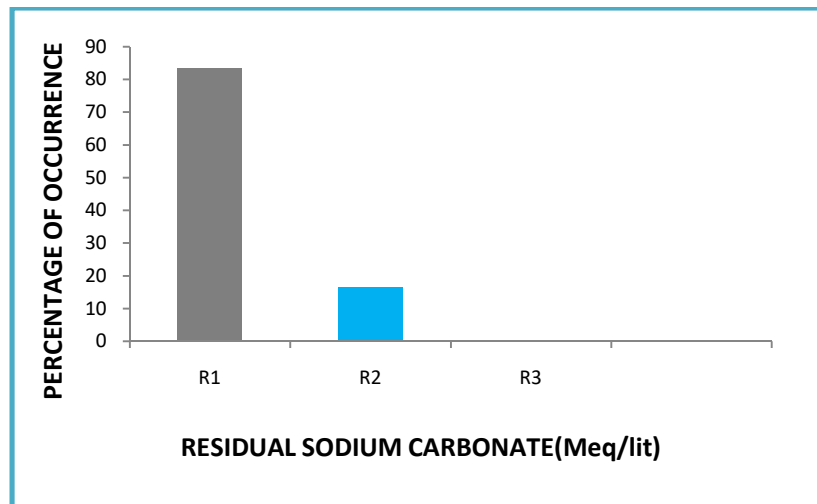


Fig. 3 Residual sodium carbonate rating

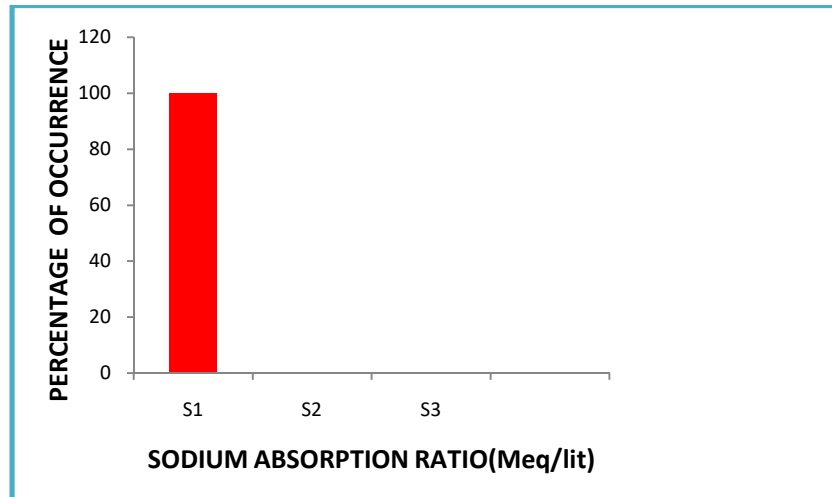


Fig. 4. Sodium absorption ratio rating

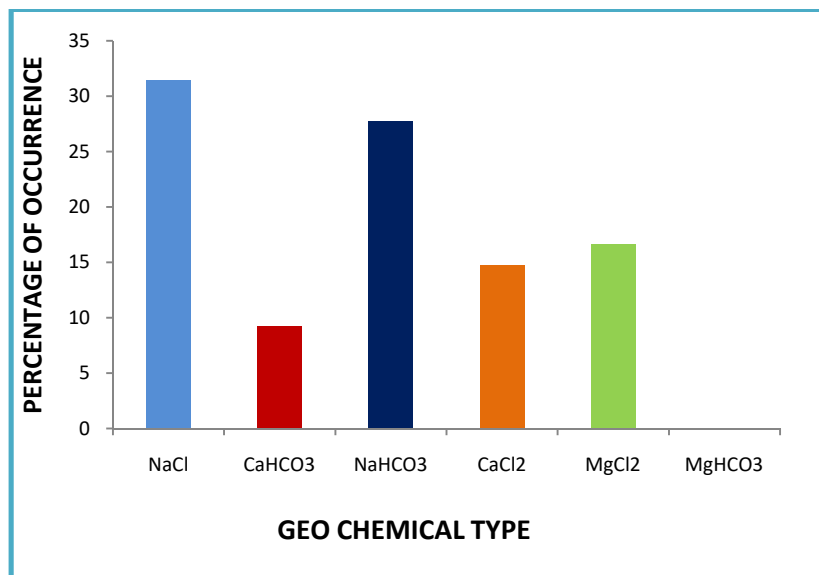


Fig. 5 Geo chemical type rating

IV. RESULTS AND DISCUSSION

In this present work the irrigation water quality of 54 bore wells covering the study area and assess the physical and chemical parameters. The PH of the ground water samples are neutral the ranges from 7.02 to 7.64 which are within permissible limits 6.5-8.5 given by Indian standards of 7.0-8.0 given by WHO [12].

The water sample analysis report of Nagapattinam taluk, reveals that the rating for the three important parameter are as follows, for electrical conductivity rating about 42.59% for C2 classification and 37.03 % for C1 classification. 20.37% for C3 classification, for Sodium Absorption Ratio rating about 100% of samples covers S1 class S2 and S3 are not found. For Residual sodium carbonate rating about 83.33% for R1 class 16.66% for R2 class. R3 classes are not found. For Geo Chemical type 31.48% for NaCl type and 27.77% for NaHCO₃ type.16.66% for MgCl₂ type. 14.81% and 9.25% respectively CaCl₂ and CaHCO₃ type. MgHCO₃ types are not present.

V. CONCLUSION

The present study of ground water samples in Nagapattinam taluk generally neutral nature. The ground water quality of irrigation water is compared based on electrical conductance, 37.03% of water is useful for irrigation without any adverse impacts on the soil and 42.59% of water moderately suitable for irrigation. 20.37% of water is not suitable for agriculture purpose. Paddy and vegetables particularly medium salinity tolerane plants are advised to cultivate to this area.

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