

Quality of ground water in the Pollachi Taluk

by

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About 87,000 acres of Pollachi taluk of the Coimbatore district is to be brought under canal irrigation under the proposed Parambikulam-Upper Aliyar Project. This area is to be benefited partly by the Upper Canal, Sethumadai canal and Aliyar feeder canal and partly by the Pollachi canal. This area now is either well irrigated or dry depending upon the availability of water in the wells. The water table is fairly high in this area and the cropping pattern is changed to suit the varied nature of the well waters. The main crops for which the water is utilised at present are groundnut, chillies, brinjal, cotton and coconut. In the area, the cropping pattern is likely to be changed by the coming in of the irrigation water in the canals fed by the Parambikulam dam due to the availability of abundant water and also due to the possibility of the quality of water being changed due to the coming in of the water from the Parambikulam area. Since in most of the areas, there is only a limited choice of irrigation water now, the cultivators at present have to make the best use of the available water whatever may be the quality of the same. As the utilisation of the low quality waters for irrigation will result in the deterioration of the land, it is imperative on the part of the cultivators to understand the nature of the available water and modify the cropping pattern. In addition to this the quality of water in wells and streams changes appreciably with the season of the year and also with the distance down from the streams or canals. In addition to this the water table of the ground waters and soils will also be influenced by the fluctuations in the canal water level and also by the quality of water flowing in the canals. As such it is a necessity on the part of soil scientists now, in view of the proposed Parambikulam Aliyar project whose canals pass through this district, to prevent any hazard to the land due to the coming in of the irrigation facilities in this project area. For the above purpose it is necessary to study the quality of the ground water prior to the coming in of the water in the canals and also after the canals have been commissioned. With the above purpose in view, the present study of the quality of the ground water was taken up.

Materials and Methods: The area, north of Pollachi with Pollachi-Udumalpet road as southern border, border of Palladam taluk as the northern boundary, the eastern border of the Erpatti

village as the eastern border, the western borders of Cholanur and Kullkapalayam as the western border was selected for the first stage of the study of the quality of ground water. Water samples were collected from each village from wells, typical of the water used in the villages for irrigation purposes. In a few villages one or two more samples were collected when it was found that the water from these particular wells differed characteristically from the water normally used in the village. The water samples were collected within a couple of days of one another to avoid any seasonal fluctuations interfering with the study and comparison of the quality of water in the area.

The water samples were analysed for the various cations (Ca^{++} , Mg^{++}) and anions (Cl^- , CO_3^{--} , HCO_3^- , SO_4^-), by the methods of analysis proposed by the U. S. Salinity Laboratory (Anon 1954), in addition to the determination of total salts by evaporating an aliquot, drying, igniting and weighing, pH using a Beckman pH meter and electrical conductivity by the use of Solubridge. Sodium was estimated as difference between the total amount of cations and anions present.

The Sodium absorption ratio which has been proposed by the U. S. Salinity Laboratory as a reliable criterion for evaluating sodium hazards of water has been worked out for all the water samples collected in this area:

$$\text{Sodium absorption Ratio (SAR)} = \frac{\text{Na}^+}{\sqrt{\frac{(\text{Ca}^{++} + \text{Mg}^{++})}{2}}}$$

The classification of irrigation waters adopted by the U. S. Salinity Laboratory based on conductances values was also adopted in this study. The modified diagram for the determination of the quality rating of an irrigation water from its Sodium absorption ratio and electrical conductivity (Thorne and Peterson 1954) has been adopted in this study.

Results: The results of analysis of the water samples from the area are presented in table I. There is a gradual variation in the quantity of water in the area and the ground waters in the Periyane gamam, Avalappampatti, northern portion of Erpatti village and Chinnampalayam are of 'marginal quality' while the ground waters in the rest of the area seem to be of good quality.

The total solids content of the samples, 16 and 18 from Periyane-gamam area is more than 2,000 p. p. m. while those from Erpatti village (S. No. 2), Sinneripalayam (S. No. 19) and Chinnampalayam (S. No. 20) area are between 1,000 p. p. m. and 2,000 p. p. m. The total solids content of the rest are less than 1,000 p. p. m.

The electrical conductivity of water samples from Avalappampatti, (S. No. 16) is more than 2,250 micromhos/cm while the samples 2, 3, 7, 12, 13, 17, 18, 19 and 20 have electrical conductivity values between 750 and 2,250 micromhos/cm. The rest of the samples have electrical conductivity less than 750 micromhos/cm

The samples 3, 11, 12, 13 and 20 have more than 2.5 meq/litre of residual carbonates while samples 5 and 7 have residual carbonate between 1.25 and 2.5 meq/litre and the rest less than 1.25 meq/litre

The pH of the water samples range from 7.1 to 8.2.

Discussion: Irrigation waters are classified into various categories depending upon (1) total solid content, (2) electrical conductivity values and (3) the residual sodium carbonate content of the irrigation waters. On the quality ratings based on the total solid content, waters containing more than 2,000 p. p. m. were considered distinctly poor; 1,000 to 2,000 p. p. m. as of 'marginal quality' and less than 1,000 p. p. m. as satisfactory. Adopting the above system, samples from Periyane-gamam area (S. No. 16 and 18) were distinctly of inferior quality, while those from Erpatti (S. No. 2) and from Sinneripalayam (S. No. 19) were of "marginal quality" and as such they have to be used with caution for irrigation purposes.

Classifying the irrigation waters on the electrical conductivity values alone, the water samples from Periyane-gamam area (S. No. 16) and Avalappampatti are unfit for irrigation while the water samples from Annuparpalayam, Cholapalayam, Rasakapalayam, Puliampatti, Negamam, Sinneripalayam and Chinnampalayam belong to medium to high salinity water category since their electrical conductivity values fall between 750 and 2,250 micromhos/cm. and can be used only in soils with moderate leaching. The other waters can be used safely under all conditions in 'permissible soils'.

Considering the sodium hazards of the ground waters based on the conductivity values and Sodium absorption ratio, the water samples 10, 16, 18 and 20 fall under S_2 class (Medium Sodium Class)

thus presenting appreciable sodium hazard in soils of high clay content and low organic matter content especially under low leaching conditions in the absence of gypsum in the soil. This quality of water can be used only in coarse textured soils with good permeability. The soils irrigated by these wells are of loamy type with low amount of organic matter, shallow in depth and undulating with improper drainage in the low reaches of the area and characterised by the absence of gypsum. As such the water from the above wells have to be used with caution to avoid the soils from becoming subjected to the sodium hazards. The water from other wells can be used without any risk of sodium hazard in the area.

But as the water under study contain fairly high amounts of bicarbonates, there will be a tendency for the Ca^{++} and Mg^{++} to precipitate as carbonates when the soil solution became more concentrated. Though this reaction never goes to completion under ordinary circumstances, still the concentrations of Ca^{++} and Mg^{++} will be reduced and the relative proportion of sodium increased proportionately. So, Eaton (1950, Quoted by Thorne and Thorne 1951, Govinda Iyer and Subramaniam, 1960) classified samples having more than 2.5 meq/litre of residual sodium carbonate as not suitable for irrigation, 1.25 to 2.5 meq/litre as marginal and less than 1.25 meq/litre as safe. Based on the concept of Eaton, the water samples 3, 11, 12, 13 and 20 are not suitable for irrigation while samples 5 and 7 are 'marginal' in their quality and the rest are safe for irrigation.

Combining the results got from the discussion about the quality of the irrigation waters of the area under study based on each of the above concepts, it is clear that the water in the Periyane-gamam area (samples 16 and 18) are of the marginal quality and have to be used with care because of the soil conditions existing in the area, since waters in this area contain high amounts of total salts, high electrical conductivity and fall under the class $\text{C}_3 - \text{S}_2$ on the basis of the quality rating adopted by Thorne and Peterson (*loc. cit.*). In this area good management practices have to be adopted for successful and profitable use of waters. The soils should be provided with adequate drainage facilities and irrigation waters must be applied in excess to provide considerable leaching and preferably salt tolerant crops should be selected as is done in some parts of Coimbatore district where well waters with such high concentration of total solids are met with.

The water samples 2, 10, 19 and 20 are better in quality than the previous ones but they have to be used with caution due to the high concentration of total solids, high conductance values and also due to possibility of appreciable sodium hazard to the soil due to the absence of gypsum in the soil and also other soil conditions present there.

The waters from the wells in other areas can be used under all conditions without much risk of sodium or salinity hazard.

Summary: A quality appraisal of the well waters of North Pollachi Taluk was made using the various concepts in the categorisation of irrigation waters. The well waters in the Periyaneagamam area can be used successfully if proper management practices are adopted as is done in other parts of Coimbatore District, where well waters with such high concentrations of total solids are met with while water found in Senguthupalayam and Sinneripalayam have to be used with a bit of caution. The rest of water found in the area can be used for irrigation without any risk of sodium or salinity hazard.

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TABLE I.
(Analysis and quality Rating of the Water Samples).

No.	LOCALITY	pH	CO ₂ (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	HCO ₃ (mg/l)	CO ₃ (mg/l)	CL (mg/l)	SO ₄ (mg/l)	SAR..	Sodium %		Residual Na ₂ CO ₃	Class	
												Found	Possible			
1.	Erpatti	...	7.3	600	836	4.0	0.90	2.73	5.6	1.0	1.03	1.73	35.79	...	0.70	C2.S1
2.	Erpatti	...	7.5	2100	1742	8.5	4.60	10.13	6.3	9.4	7.53	3.93	43.59	60.03	...	C3.S1
3.	Anuparpalayam	...	7.6	800	502	3.2	0.90	4.10	7.1	1.0	0.10	2.86	50.00	...	3.0	C3.S1
4.	Peringoundanur	...	7.8	600	270	3.4	1.80	1.83	5.2	0.8	1.03	1.14	26.03	100.00	...	C2.S1
5.	Unjavelampatti	...	7.5	450	850	2.3	0.92	3.26	5.4	0.8	0.28	2.57	50.19	...	2.18	C2.S1
6.	Subbiahgoundenpalalayam	...	7.2	450	196	3.0	0.88	0.99	3.8	1.0	0.07	7.11	20.32	92.51	...	C2.S1
7.	Cholapalayam	...	7.6	800	1002	2.9	1.39	5.32	6.6	1.6	1.41	3.63	55.37	...	2.30	C3.S1
8.	Muthampalayam	...	7.7	700	626	3.8	0.72	3.42	5.0	1.4	1.54	2.33	43.07	...	0.48	C2.S1
9.	Chengottupalayam	...	7.8	550	936	3.6	0.90	1.59	4.8	1.2	0.09	1.06	26.11	...	0.30	C2.S1
10.	Cholanur	...	7.7	550	834	2.8	1.42	1.22	4.5	0.8	0.14	8.40	22.43	...	0.28	C2.S2
11.	Sadayagoundanur	...	7.7	700	1014	2.4	0.81	3.81	6.0	1.0	0.02	3.05	54.28	...	2.79	C2.S1
12.	Rasakkapalyam	...	7.5	1000	820	3.4	1.33	7.72	7.7	2.2	2.55	5.03	62.01	...	2.97	C3.S1
13.	Puliambatti	...	7.1	900	900	3.4	0.18	6.11	7.6	2.0	0.09	4.57	63.05	...	4.02	C3.S1**
14.	Puliambatti	...	7.9	600	330	2.9	1.07	2.97	5.2	0.8	0.94	2.11	42.80	...	1.23	C2.S1
15.	Kadayanpalalayam	...	7.2	400	973	2.8	0.09	0.38	2.8	0.4	0.07	3.16	11.62	25.85	...	C2.S1
16.	Avalappampatti	...	7.7	2800	2156	8.2	0.43	10.84	5.2	13.0	1.27	5.22	55.66	75.95	...	C4.S2
17.	Neganam	...	7.4	800	1000	3.6	1.12	5.02	4.3	1.0	3.90	3.27	51.23	91.20	...	C3.S1**
18.	Neganam	...	7.7	2200	2126	10.0	1.26	16.51	4.5	4.2	19.07	6.96	59.26	56.36	...	C3.S2
19.	Sinneripalayam	...	7.2	1600	1936	7.0	0.27	4.88	4.7	5.6	1.85	2.56	40.17	64.75	...	C3.S1
20.	Chinnampalayam	...	8.2	1100	1274	2.0	0.52	8.12	7.5	2.3	0.84	7.24	76.32	...	5.0	C3.S2

** Differs from the general character of the waters in the village.