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Progressive Changes in the Quality of Water in the River Pennaiyar and Canals in the Krishnagiri Project

K. K. KRISHNAMOORTHY[1], P. MUTHUSWAMY[2] and K. GOVINDARAJ[3]

In the river Pennaiyar, its tributaries and irrigation canals, 27 places were selected and water samples were collected at monthly intervals and analysed. The results showed that the water in all the places had medium salinity hazard (EC of 0.25 to 0.75 mmhos/cm) whereas the stream at Periyapallam had high salinity hazard. The sodium adsorption ratio was in the range of 2.28 to 6.61 (low sodium hazard). The RSC was within the marginal limit in 76 per cent of locations. The quality of water along the river course and in the right main canal had not varied appreciably. But higher EC, pH, SAR, RSC and SSP values were observed in LMC after leaving the Mohamed Ghouse tank. Thus Mohamed Ghouse tank served as a source of salt for the water flowing in left main canal.

The Krishnagiri reservoir was constructed in the year 1957 across the river Pennaiyar in Dharmapuri district of Tamil Nadu. About 9000 acres of land are being irrigated by the water from this dam. The new area brought under the fold of this project received irrigation for the past 19 years. Recently reports have been received from this area about the development of alkalinity in certain locations of the ayacut. So with a view to assess the quality of the river water and its canals, this study was undertaken.

MATERIALS AND METHODS

The entire catchment and ayacut area of the river, Pennaiyar was surveyed and sampling sites were selected to represent the whole project area with regard to the storage and distribution of water for irrigation, and the water stored in the dam. Two canals are taken from the dam, one on the left side of the dam called left main canal (LMC) and the other on the right side called right main canal (RMC). The left main canal has a total length of 18 km. The water in the LMC after running for a distance of 3 km is fed into the Mohamed Ghouse tank and is then taken on the eastern side for irrigation. In LMC water is taken for irrigation at several convenient points and finally the canal water enters the Baleguli tank. The RMC runs through a total distance of about 14 km and ends in Kottaiyur tank. In both the canals, water samples were taken at a distance of every two kilometers and analysed. The sampling commenced from September, 1973 and the samples

1-3 : Department of Soil Science & Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore-641003

were taken at monthly intervals for ten months. Twentyeight locations were selected along the course of river and canal and all the 280 samples collected during these periods were analysed for their EC, pH Co_3, HCo_3, Ca, Mg, K and Na by adopting the procedure described in USDA Hand book No. 60 (Richards, 1954).

RESULTS AND DISCUSSION

The results of analysis for EC and the calculated quality indices viz., SAR, RSC and SSP of waters are presented in Tables I and II for different locations in the river and canal and for the different months of sampling respectively. The EC of the samples ranged from 0.61 to 0.84 mmhos/cm.

Based on Richards' system of classification (1954) of irrigation water using the salt content, the river and canal water in all the locations under investigation could be classified as C_2 class of medium salinity (EC of 0.25 to 0.75 mmhos/cm). Only the stream in Periyapallam which formed a tributary to the main river had higher EC value (0.84). During summer months the salt content of the water increased (Table II). The pH of the water in different locations ranged from 7.74 to 8.07.

The sodium adsorption ratio (SAR) of the river and canal water ranged from 2.28 to 6.61. So in all the ocations from which water samples have been analysed the SAR was within the limit of low sodium hazard

TABLE I. Quality of river and canal water.

Sample No.	EC × 10^3	pH	SAR	RSC (meq/l)	SSP
(a) **Quality of river water upto the dam site:**					
1	0.84	7.80	3.04	3.34	53.72
4	0.62	7.94	2.75	1.76	54.06
5	0.62	7.74	3.25	1.85	57.69
8	0.73	7.78	3.93	3.32	56.24
11	0.68	7.88	3.14	2.72	57.67
41	0.66	8.01	3.34	1.85	59.06
Mean	0.69	7.86	3.24	2.47	56.41
(b) **Progressive changes in quality of water in LMC:**					
i) Before entering into Mohamed Ghouse tank.					
41	0.66	8.01	3.34	1.85	59.06
23	0.66	7.91	2.28	1.82	47.93
22	0.61	7.87	2.38	1.68	50.81
Mean	0.64	7.93	2.67	1.78	52.60
ii) Just at the point of entry into the tank.					
19	0.72	8.04	4.27	2.88	64.87
iii) Along the course of the canal after leaving the Mohamed Ghouse tank.					
27	0.73	7.98	6.61	3.73	72.22
29	0.70	7.97	5.64	3.17	68.76
30	0.72	7.93	5.32	2.63	68.56
33	0.66	7.96	5.91	1.98	68.87
34	0.76	8.04	5.00	1.95	66.06
35	0.74	8.06	5.05	2.36	67.61
36	0.77	8.03	4.79	1.89	64.12
37	0.74	8.07	4.51	2.41	64.30
Mean	0.73	8.01	5.35	2.52	67.56
(c) **Progressive changes in RMC:**					
42	0.62	7.99	3.22	1.70	56.38
43	0.63	7.88	3.03	1.35	53.96
44	0.61	7.90	3.11	1.51	55.37
45	0.63	7.96	3.18	2.28	54.79
47	0.62	7.94	3.19	1.48	54.99
48	0.62	7.91	2.96	1.50	53.48
50	0.62	7.85	3.49	1.48	56.13
51	0.66	7.93	2.92	2.46	51.42
52	0.68	7.90	3.22	1.61	55.98
55	0.60	8.02	3.29	1.49	57.20
Mean	0.62	7.97	3.22	1.60	55.96

TABLE II. Quality of river water during different months (Mean values)

	9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	9/74	10/74	Mean
EC X 10^3	0.58	0.66	0.61	0.63	0.76	0.75	0.81	0.75	0.66	0.58	0.68
pH	7.86	7.81	7.71	7.73	7.85	7.86	9.54	8.57	7.84	7.72	7.95
SAR	3.35	3.79	4.22	3.39	4.13	4.14	6.00	3.90	2.82	2.01	3.78
RSC (meq/1)	3.04	2.47	2.18	1.78	1.67	2.07	2.66	2.57	1.78	1.37	2.16
SSP	59.45	58.09	62.53	59.37	63.29	64.36	68.08	58.78	51.06	43.45	58.65
Rain fall in mm	274.4	110.20	35.4	22.0	Nil	Nil	Nil	6.4	465.8	204.4	—

of SAR less than 10, based on Richards' classification. So these low sodium waters could be used for irrigation almost in all the soils with little danger of development of harmful levels of exchangeable sodium.

The estimation of residual sodium carbonate in evaluating quality of water was also important. Eaton (1950) proposed that water with RSC less than 1.25 me/l as suitable, between 1.25 and 2.5 as marginal and above 2.5 unsuitable for irrigation. He also suggested that waters with high RSC would lead to the development of alkalinity in irrigated soils. The RSC value of the water samples analysed ranged from 1.35 to 3.73 me/l. In about 74 per cent of the places of the river and canal, the RSC values were within marginal limit. However, in about 26 per cent of the places, RSC was in the unsuitable range.

The SSP ranged from 47.93 to 72.22. Wilcox and Magistad (1943) proposed the limits based on SSP. Waters with SSP of values less than 60 were grouped as class I (excellent to good). Class II between 60-75 (good to injurious) and class III more than 75 (injurious to unsatisfactory). More than 66 per cent of the water analysed would be classed as class I (excellent to good) and the remaining 33 per cent as class II. All the samples analysed in LMC after its exit from Mohamed Ghouse tank can be grouped under class II.

The quality of water was assessed from its catchment area to the tail end of LMC and RMC. It was observed that the quality of water upto the dam site and its course throughout the length of RMC did not vary much. But in LMC the quality of water was much affected. From the perusal of the data in Table I, it could be observed that Mohamed Ghouse tank formed a main source of contamination for the deterioration of the quality of water in LMC. All the quality indices such as EC, pH, SAR, RSC and SSP had increased values.

Particularly the SAR had increased from a mean value of 2.67 to 5.35. The main cause for the deterioration of quality of water in the Mohamed Ghouse tank might be attributed to the high salt content which the tank water had received from the catchment area. This area was mainly a vast stretch of alkaline land. So salt which accumulated in the tank during the rainy season was mixed in the canal water and carried in LMC. However, this LMC canal water could be used for irrigation with adequate precautions such as providing drainage in the soil and by application of gypsum as the RSC value was more than 2.5 me/l. Gopalswamy *et al*. (1971) also observed such higher values of quality indices in the LMC than the dam water itself.

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