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A Study on the Alkali Soils of the Krishnagiri Reservoir Project Area

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Of late considerable emphasis has come to be laid on augmenting food production by all possible means. In this, the role of irrigation projects needs no emphasis. The irrigation projects, instead of being 'saviour' to the farming community, sometimes bring in their wake problems of salinity and alkalinity. The Krishnagiri Reservoir Project in Dharmapuri district is one such, and more than one third of the total ayacut of 5,000 acres under its left main canal have become completely alkaline in the course of six years from the inception of the project. The causes for alkalinity in this area and the remedial measures for reclaiming the affected fields and the prospects of growing high yielding varieties in this area are discussed in this paper.

Review of literature : Sanyasi Raju and Govinda Iyer (1955) reported that in the Cauvery-Mettur Project area, application of 5,000 lb of green manure was better than that of gypsum at 2½ tons per acre and other chemical ameliorants in the reclamation of alkali lands for better crop performance. Govinda Iyer *et al.* (1963) observed that there was a close correlation between the exchangeable sodium percentage values and pH of the alkali soils of the Amaravathy ayacut area. Velayutham *et al.* (1967) in their study on the characteristics and reclamation of a typical alkali soil of Somayanuloor farm, Madurai, also reported a close correlation between the exchangeable sodium percentage value and the pH of the alkali soil. Krishnamurthy and Premanathan (1968) studied the problems of salinity and alkalinity besetting the paddy fields adjoining the sea-coast in Tamil Nadu and suggested remedial measures for overcoming them.

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Materials and Methods. The Krishnagiri Reservoir Project which is built across the river South Pennar irrigates about 8,850 acres with its right and left main canals. The right main canal runs to a distance of 8 miles and 6 furlongs along the contour and irrigates about 4,000 acres with its branch channels. On the other hand, the left main canal after running to a distance of about 2 miles and four furlongs along the contour enters the Mohammed Ghouse tank, popularly known as Avathanapatti tank and irrigates about 5,000 acres.

Water samples numbering seven were collected from (1) the western side of the dam (Bellaramballi village) (2) sluice of the left main canal in the reservoir (3) point of entry of the left main canal into the Mohammed Ghouse tank (4) centre of the Mohammed Ghouse tank (5) point of take-off of the left main canal (6) surplus channel from the Thimmapuram tank and (7) profile pit dug in the Thimmapuram village. The water samples were analysed for their various anions and cations.

Five profile pits were dug, four in the ryots' fields of Thimmapuram and Chowtahalli villages and the fifth one in the farm of the Rural Extension Training Centre, Krishnagiri. In all, twenty one samples were collected and analysed for their EC, pH, total solids content, alkalinity, cation exchange capacity and exchangeable calcium, magnesium, sodium and potassium.

Results and Discussion: Out of the total ayacut of 8,850 acres commanded by the Krishnagiri Reservoir Project, nearly 2,000 acres turned alakaline in the course of six years from the inception of the project. Out of these 2,000 acres, 1,800 acres were commanded by the left main canal while the remaining two hundred acres were commanded by the right main canal. The worst affected areas are located in the villages of Chowtahalli and Thimmapuram. In these villages, the severity of the problem was clearly brought out by the presence of 'black alkali' patches in the paddy fields and by the patchy growth of paddy. This was further accentuated by the fact that in some areas, only sedge plants, instead of paddy, were noticed. Even testing the stagnant water in these fields with pH indicator paper showed that the pH of the soil solution exceeded 11. Therefore, it was necessary to study this problem from two angles, namely, soil and water.

From Table 1 in which the results of analysis of water are presented, it is seen that the water samples drawn from the western side and the left main canal of the Krishnagiri Reservoir Project were safe for irrigation since their Sodium adsorption ratio and Residual sodium carbonate values did not exceed 8.0 and 2.5 respectively (Wilcox, 1955). Further, the electrical conductivities of these water samples were also below the critical limit of 1. Even judging them in the light of their electrical conductivity and Sodium adsorption ratio, the above water samples were safe for irrigation. Though the Residual sodium

TABLE 1. *Results of analysis of water samples collected from K.R.P. area*
Expressed in me %

Heads of analysis	K.R.P. dam		Mohammed Ghouse tank (Thimmapuram village				
	Western side	Left main canal	North west corner	South west corner	Centre	Surplus channel	Profile pit
CO_3^{--}	0.8	0.8	—	—	—	1.6	4.0
HCO_3^-	4.06	4.06	4.06	4.06	4.06	8.53	18 3
SO_4^{--}	1.71	2.06	2.06	1.71	2.06	1.37	3.43
Cl_2^-	1.97	1.97	2.37	2.37	2.37	3.95	9.48
Ca^{++}	1.52	1.44	1.04	1.36	1.28	1.36	1.01
Mg^{++}	1.18	1.03	0.47	—	—	1.74	1.74
Na^+ (By difference)	4.89	6.35	6 91	6.72	7.15	12.50	32.11
Total solids in ppm	540	590	580	560	560	990	2240
EC	0.6	0.6	0.7	0.7	0.6	1.5	3.2
pH	8.0	8.2	7.6	7.7	8.0	8.3	8.2
SAR	4.21	5.72	7.96	8.92	8.95	11.63	30.12
RSC	2.16	2.39	2.55	2.70	2.78	7.03	19.55
Classification	C_2S_1	C_2S_1	C_2S_2	C_2S_2	C_2S_2	C_3S_2	C_4S_4

carbonate values of the water samples drawn from the centre, North-west and South-west corners of the Mohammed Ghouse tank were slightly more than 2.5 me/litre which is the safe limit propounded by Wilcox (1955), these water samples could not be altogether condemned as unsuitable for irrigation since they could be used on soils with good drainage facilities. But in the case of water samples drawn from Thimmapuram tank surplus channel, and profile pit dug in Thimmapuram village, the Sodium adsorption ratio and Residual sodium carbonate were found to be far above the safe limits. Therefore they were not suitable for irrigation.

It is seen from the results of analysis of soil samples presented in Table 2 that all the soil samples collected from the ryots' fields in the villages of Thimmapuram and Chowtahalli and Rural Extension Training Centre farm were alkali ones (excepting sample No. 17) as evidenced by their low electrical conductivity and high exchangeable sodium percentage values. The black alkali nature of these soil samples was also brought out by their high bicarbonate content. The total solids of these soils also exceeded 1200 ppm which is the safe limit for good crop growth. The ratio between calcium and sodium ions was also found to exceed 1 : 2 which is the optimum for less adsorption of sodium (Kelley *et al*, 1940).

As the water of the Krishnagiri Reservoir Project was of good quality, the alkalinity of the lands commanded by the left main canal must have been brought about by the upward movement of salts from lower regions. This

Analysis of soil samples collected from the Krishnagiri Reservoir Project area

Name of place	Survey No. or block No.	Depth of profile (inches)	pH	EC in millimhos cm.	Total solids (ppm)	CO_3 – –	HCO_3 –	SO_4 – –	Cl_2 –	Ca + +	Mg + +	* Na	CEC me %	Exchangeables (me/100 gm of soil				Exchangeable Na %
														Ca	Mg	Na	K	
Thimmapuram	258/1	0–4	8.6	0.3	2620	20	20.0	12.91	7.33	3.99	0.98	26.53	12.4	6.0	1.0	4.16	0.02	33 5
,,	,,	4–8	8.9	0 5	2690	—	20.0	14.99	7.33	2.49	—	23.04	12.7	7.0	1.2	5 07	0.02	39.4
,,	,,	8–14	10.1	0.7	3350	—	9.9	9.16	24.53	3.99	7.07	14 35	13.3	5.5	1.4	8.00	0.01	60.1
,,	,,	14–24	8 4	0.2	1410	—	14.9	1.87	7.33	3.49	1.23	19.56	15.2	6 5	1.7	8.83	0.01	53.1
,,	273	0–7	9.1	0.5	2540	—	20.0	6.87	9.87	3.49	0.98	26.53	8.7	5 5	1.4	3.25	0.01	37.3
,,	,,	7–12	8.2	0.6	2640	—	14.9	5.83	7.33	2.99	0.49	20.00	11.4	5.0	1.1	4.20	—	36 3
,,	,,	12–16	8.5	0.5	2420	—	20.0	16.44	7.33	1.99	—	26.53	10.5	6.5	1.0	4.55	—	43.3
,,	,,	16–22	9.8	0.6	2820	—	17.54	10.11	9.87	3.89	—	45.65	9.5	4.5	0.8	4.55	—	47.9
Chowtahalli	240/5	0–5	8.3	0.75	2620	—	10.0	14.99	19.74	3.89	1.96	25.22	11 6	5.0	0 9	4.94	0.04	42 6
,,	,,	5–11	8.6	0.5	1800	—	17.5	2.48	12.41	1.99	1.96	15.65	12.9	5.5	1.8	5.85	0.02	45.3
,,	,,	11–24	7.6	0.4	1720	—	14.9	2.48	7.33	1.99	1.47	25.65	15.9	7.5	2.0	5.80	0.02	36.4
,,	227/3	0–3	9.9	0.9	2900	55	2.46	12.28	16.08	3.49	3.43	34.35	10 8	6.0	0.8	4.55	0.02	42 1
,,	,,	3–9	8.8	0.7	3380	10	17 50	4.16	14.66	3.49	2.45	34.35	8 7	5.5	1.8	4.16	0.02	47.8
,,	,,	9–13	8.7	0.7	3300	—	24.91	12.70	14.66	3.49	2.94	19.56	14.6	4.5	1.0	9.18	0.02	62.0
,,	,,	13–15	10.0	0.65	3440	40	4.91	5.83	19.74	1.99	0.98	23.04	12.5	4.0	0.4	8 49	0.02	67.9
,,	,,	15–30	8 4	0.55	2540	—	17.50	13.11	12.13	3.99	2.94	8.26	25.8	3.5	1.6	17.55	0.02	67.9
R.E.T.C. farm	'F'	0–3	8.1	0.35	1480	—	12.45	3.99	9.87	6.49	4.11	9.57	16.5	14.5	1.6	2.17	0.02	13.2
,,	,,	3–13	8.6	0.30	1780	—	14.90	8.12	9 87	3.49	1.47	9.13	18.0	15.5	1.7	3.56	0.02	19.7
,,	,,	13–17	8.6	0.30	1840	—	12.45	9.37	9.87	3.99	0 98	11.74	18.8	16.5	2 5	2 80	0.02	14.8
,,	,,	17–29	8.5	0.30	1880	—	14.90	0.83	12.13	4.48	1.96	16.09	20.5	16.5	2.3	4.91	0.01	23.9
,,	,,	29–39	8.5	0.40	2500	—	17.50	13.11	9 87	3.49	1.47	20.86	21.2	14.5	2.3	5.01	0.01	23.9

* Sodium by difference

was also corroborated by the fact that seepage water was met within the profile pit dug in the Timmapuram village for examination.

Therefore it was recommended that in the first instance (1) The seepage water should be drained out. For this, drains of desired length and breadth should be dug all around the field according to the contour of the land. (2) Then requisite quantities of gypsum should be applied to the field and ploughed in. (3) Irrigation water of good quality should be allowed to stagnate in the field treated with gypsum so that gypsum might percolate into the soil and replace the sodium from the exchange complex with calcium. (4) After irrigating the field twice or thrice as stated above, daincha should be raised and ploughed insitu. This should be followed by growing salt-resistant strains of paddy like SR 26B and PVR 1. (5) After normal crop growth has been attained in the reclaimed field, high yielding strains like ADT 27 need to be grown.

Out of the total ayacut of 8,850 acres commanded by the Krishnagiri Reservoir Project, nearly 2,000 acres turned completely alkaline. Both soil and water samples collected respectively from the alkali lands of Thimmapuram and Chowtahalli villages and the Krishnagiri Reservoir Project were examined for the causes of alkalinity and remedial measures suggested.

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