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Salinity Problem in Taluka Ratodero District Larkana, Sindh Pakistan

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Abstract: Salinity is one of the major factors for low crop production in the district Larkana, Sindh, Pakistan. To assess the salinity problem, salt-affected soils of taluka Ratodero, district Larkana were surveyed. Composite (100) soil samples of four (0-20, 20-40, 40-60 and 60-80 cm) depths from 25 excavated soil profiles were collected and analyzed. Most of the soil samples were medium to heavy in texture, alkaline in reaction (pH 7.7 - 8.8) and non-saline to strongly saline (EC 0.67 - 40.20 dSm^{-1}) in nature. These soils were placed into 4 different classes i.e. Non-saline, Saline, Saline-sodic and Non-saline-sodic. It was further observed from the profiles excavated at salt-affected areas, that some profiles were superficially and others were deeply salt-affected.

Key Words: ESP, Salinity, SAR, Survey, Soil Profile

Introduction

Soil salinity poses a serious problem rendering millions of hectares of world's agricultural land less productive for cultivation. Land salinisation is major cause of desert formation in Pakistan; where about 6.3 m ha land is salt-affected (Qureshi and Lennard, 1998).

Several reports including Agriculture Statistics of Pakistan (1997-98) indicate that the problem of salinity is widely spread in Sindh province, where more than 70 % of all agricultural land is moderately or severely salinised and waterlogged. The problem is primarily associated with arid and semi-arid climate. Seepage from unlined largest artificial canal irrigation network, land slope from north towards sea (1 ft/mile), low annual rainfall, evaporation from the soil surface and transpiration from crops due to high temperature, irrational use of irrigation water, nature of parent material, application of saline irrigation water, upward movement of ground water, impeded drainage and flooding by sea water in coastal areas (Thatta and Badin districts) have also been reported as the major causes of the land salinisation in Sindh.

Soil salinity not only degrades the soils of Sindh but also gives economic losses by decreasing per acre crop yield. It has been estimated by several workers including Qayoum and Malik (1985) that the annual losses caused by salinity in Indus basin is about 20 billion rupees. Some studies regarding the salinity status are available for other districts including Hyderabad (Rajpar and Sial, 1997), to the knowledge of authors, but very little is known about the salinity problem in Larkana district.

The present study was carried out to asses the salinity problem in taluka Ratodero, district Larkana. The soils of the study area are irrigated with both seasonal as well as perennial system. The major crops grown are rice, sugar cane and guava.

Materials and Methods

Salt-affected areas of taluka Ratodero, district Larkana were widely surveyed. Composite soil samples of 0-20, 20 -40, 40 - 60 and 60-80 cm depths were collected from the profiles excavated at 25 sites (Table 1) during January-Feburary. The samples were air dried, crushed and passed through 2 mm sieve. All the analyses related to salinity assessment were followed using the methods described by USSL (1954). Soil texture was determined using Bouyoucos hydrometer method. The SAR, ESP and RSC were computed using the methods suggested by Rowell, (1994) and Qureshi and Lennard, (1998). The data were used to calssify the salt-affected soils of the surveyed area into Saline, Saline-sodic and Sodic soils following the methods of USSL, (1994) and Qureshi & Lennard, (1998).

Results and Discussion

It is evident from the data presented in the Table-2 that the soils of surveyed area were sandy clay loam to clay, in texture, alkaline in reaction with pH ranged between 7.5 and 8.8. Organic matter content was low (0.04-1.13%) which decreased with increasing soil depth. The soils were calcareous (7.5-21.5%) in nature with irregular distribution of $CaCO_3$ content within the profile (data not shown). It is also evident from the research reports of other districts (Rajpar and Sial, 1997, Khokhar, 1995 and Jatoi, 1996), that the soils of Sindh are low in organic matter content, alkaline in reaction and calcareous in nature. Similar trends have also been observed by Chang, 1974 and Sial, 1985.

The EC values indicated that the concentration of soluble salts generally decreased with increasing soil depth (Table-2). That was possibly due to the capillary rise of water along with dissolved soluble salts (Sial, 1985) in it.

As the concentration of CO_3^{2-} and HCO_3^- in most of the cases except very few sites, not exceeded than that of Ca+Mg concentration, the calculated values of RSC were negative. Following the USSL, (1954) the EC, pH, SAR and ESP values of some sites were typical to that of Non-saline (site no. 6, 14, 18, 19, and 23), Saline (1, 2, 5, and 8), Saline-sodic (site no. 9, 10, 11, 12, 15,17and 24) and Non-saline sodic soils (4 and 22). The salt-affected sites of the study area were deeply (4, 8, 9, 10, 11, 15, 16, 17, 21, 22 and 24) and superficially salt-affected (1, 2, 5, 6, 7, 13, 14). Similar trend was also observed by Rajpar and Sial, (1997) in their study of salt-affected soils of district Hyderabad, Sindh.

Table 1: Sampling Sites at Various Dehs of Taluka Ratodero, District Larkana

Site No.	Deh	Site No.	Deh
1	Bungoldero	14	Mevo Ghangro
2	Mullah Kalhoro	15	Bhando
3	Dodo Khan	16	Nazar Ghangro
4	Validad Vessar	17	Pir Bux Bhutto
5	Mamo Junejo	18	Masudero
6	Drabhi	19	Punjo Abro
7	Taib	20	Gachal
8	Chhajra	21	Naodero
9	Ratodero	22	Saidodero
10	Bosan	23	Khairodero
11	Pawro	24	M.K. Jalbani
12	Waris Dino	25	Unar
13	Wassayo Bhutto		

Table 2: Some Physico-Chemical Characteristics and Classification of Soil Profiles Excavated at Different Salt-Affected Sites of Taluka Ratodero, District Larkana

Site No.	Depth (cm)	Textural Class	pH (1:5)	EC (dS/m)	ESP	SAR	RSC	Class
1	0-20	Silty clay	8.0	12.02	11.26	17.58	-25.7	S
	20-40	Clay	7.9	4.47	11.66	24.36	2.5	S
	40-60	Clay	8.2	4.91	13.70	19.42	4.8	N.S.S
	60-80	Clay	8.2	3.22	12.98	3.31	-7.0	N.S
2	0-20	Clay	7.8	8.41	11.25	8.53	-32.4	S
	20-40	Silty clay	7.8	4.72	12.38	7.25	-9.3	S
	40-60	Clay	7.8	3.60	9.77	2.93	-13.5	N.S
	60-80	Clay	7.8	3.37	12.75	2.97	-10.3	N.S
3	0-20	Clay	8.1	7.10	11.94	12.65	-15.0	S
	20-40	Clay	8.0	4.40	10.11	15.34	2.5	S
	40-60	Clay	8.3	3.77	12.99	18.75	--	N.S
	60-80	Clay	8.6	3.54	13.11	14.79	-1.5	N.S
4	0-20	Clay	8.4	7.26	18.90	27.20	0.0	S.S
	20-40	Clay	8.5	2.19	21.91	6.85	1.0	N.S.S
	40-60	Clay	8.7	2.42	22.27	7.01	-1.1	N.S.S
	60-80	Clay	8.6	1.14	16.98	7.83	2.5	N.S.S
5	0-20	Clay loam	8.1	8.07	12.72	4.30	-46.9	S
	20-40	Clay	7.7	4.76	10.78	2.65	-25	S
	40-60	Silty clay	7.8	3.61	11.15	3.39	-13.7	N.S
	60-80	Clay loam	7.9	3.32	12.10	3.66	-6.4	N.S
6	0-20	Clay	8.3	5.98	11.45	25.73	3.2	S
	20-40	Clay	8.8	1.73	14.51	7.89	2.0	N.S
	40-60	Clay	8.7	1.92	13.73	3.99	-3	N.S
	60-80	Clay	8.7	1.46	14.33	4.75	-3	N.S
7	0-20	Clay	8.0	7.33	13.81	5.49	-35	S
	20-40	Clay	7.8	4.63	13.76	4.76	-19.1	S
	40-60	Sandy clay	8.0	2.03	5.67	11.42	--	N.S
	60-80	Clay	8.0	1.83	8.36	8.96	0.6	N.S
8	0-20	Clay	7.6	14.80	14.24	16.11	-34.7	S
	20-40	Clay	7.6	9.06	14.45	12.91	-26.2	S
	40-60	Silty clay	7.6	10.16	13.20	15.88	-20.0	S
	60-80	Clay	7.8	7.57	16.76	5.44	-8.8	S.S

9	0-20	Clay	7.9	16.17	25.43	29.72	-29.7	S.S
	20-40	Clay	7.7	6.17	21.67	38.76	0.7	S.S
	40-60	Silty caly loam	8.0	6.03	16.90	26.51	1.3	S.S
	60-80	Sandy clay	8.2	2.96	10.78	18.64	4.2	N.S
10	0-20	Clay loam	7.5	40.20	14.33	52.77	-40.5	S
	20-40	Clay	7.9	17.58	18.56	27.27	-37.1	S.S
	40-60	Clay	7.8	9.24	21.30	33.18	-8.8	S.S
	60-80	Clay	7.8	9.71	16.68	39.50	-4.7	S.S
11	0-20	Clay	7.7	12.33	16.83	13.48	-39.5	S.S
	20-40	Silty clay	7.6	7.42	20.00	10.67	-23.2	S.S
	40-60	Clay	7.9	3.89	19.35	13.90	-4.9	S.S
	60-80	Clay	7.8	3.65	11.80	16.15	-2.7	N.S
12	0-20	Silty clay loam	8.4	14.18	18.04	19.55	-32.5	S.S
	20-40	Clay loam	7.8	5.46	16.85	7.89	-22.4	S.S
	40-60	Clay loam	8.0	2.19	14.88	9.02	-2.0	N.S
	60-80	Clay loam	8.0	1.98	13.63	6.06	-4.7	N.S
13	0-20	Clay loam	8.4	7.37	12.86	41.08	2.2	S
	20-40	Sandy clay loam	8.3	2.63	9.68	17.60	2.6	N.S
	40-60	Sandy clay loam	8.5	o.88	4.52	18.32	0.9	N.S
	60-80	Sandy clay loam	8.5	o.69	4.63	5.62	-0.7	N.S
14	0-20	Clay	8.8	12.12	17.42	15.77	-9.0	S.S
	20-40	Sandy clay loam	8.2	3.28	10.81	27.57	11.2	N.S
	40-60	Sandy clay loam	8.4	3.53	5.10	18.96	4.3	N.S
	60-80	Sandy clay loam	8.0	3.01	6.47	14.33	2.1	N.S
15	0-20	Clay	7.8	17.45	17.25	24.09	-29.5	S.S
	20-40	Clay	7.5	12.77	15.85	18.84	-24.8	S.S
	40-60	Clay	8.2	14.28	21.18	26.16	-17.1	S.S
	60-80	Clay	7.6	11.69	19.63	46.39	-3.1	S.S
16	0-20	Clay loam	7.8	6.22	12.78	5.09	-34.7	S
	20-40	Silty clay loam	7.8	4.81	11.73	7.42	-14.4	S
	40-60	Silty clay	7.7	4.89	20.14	25.93	-1.5	S.S
	60-80	Clay loam	7.6	5.59	18.26	28.45	-3.0	S.S
17	0-20	Clay	7.7	18.41	18.48	19.22	-26.0	S.S
	20-40	Silty clay	7.5	8.85	15.27	11.77	-20.0	S.S
	40-60	Silty clay	7.8	6.73	18.92	17.13	-8.4	S.S
	60-80	Silty clay	7.7	5.47	20.17	16.17	-6.4	S.S
18	0-20	Clay	8.2	2.66	8.89	0.93	-13.8	N.S
	20-40	Silty clay	7.7	2.16	5.10	2.22	-11.9	N.S
	40-60	Clay	8.2	2.43	12.13	6.79	-6.1	N.S
	60-80	Clay	7.8	2.69	12.23	4.48	-1.0	N.S
19	0-20	Clay	8.1	3.35	10.95	13.07	1.7	N.S
	20-40	Clay	8.0	2.30	9.02	8.95	4.7	N.S
	40-60	Clay loam	8.1	1.70	5.20	7.35	2.0	N.S
	60-80	Clay loam	8.5	1.25	4.14	3.02	-1.7	N.S
20	0-20	Clay loam	8.0	4.35	9.96	11.75	-6.0	S
	20-40	Clay	8.4	2.03	7.29	18.02	5.0	N.S
	40-60	Clay	8.5	8.12	14.93	84.20	2.2	N.S.S
	60-80	Clay	8.4	2.70	14.59	21.81	0.5	N.S
21	0-20	Clay	8.8	14.35	22.06	98.47	6.2	S.S

	20-40	Clay	8.2	6.81	26.91	56.71	5.8	S.S
	40-60	Clay	8.3	4.80	20.56	3.40	-21.8	S.S
	60-80	Clay	8.2	3.44	14.48	15.15	-1.3	N.S
22	0-20	Clay	8.4	1.78	14.25	7.27	-0.2	N.S
	20-40	Clay	8.8	0.83	18.27	4.38	-0.8	N.S.S
	40-60	Silty clay	8.8	2.04	16.61	2.90	-9.5	N.S.S
	60-80	Silty clay	8.6	0.70	17.97	0.30	-3.7	N.S.S
23	0-20	Silty clay	7.8	4.54	14.07	25.32	3.2	S
	20-40	Clay loam	8.5	2.18	11.10	9.21	1.2	N.S.S
	40-60	Silty clay loam	8.3	1.99	9.69	12.00	1.6	N.S.S
	60-80	Clay	8.6	1.72	14.62	12.00	0.2	N.S.S
24	0-20	Clay	7.7	11.30	16.66	14.85	-29.1	S.S
	20-40	Clay	7.6	4.80	16.81	9.12	-13.3	S.S
	40-60	Clay	7.9	5.30	18.50	8.34	-10.2	S.S
	60-80	Clay	7.8	3.05	14.86	8.20	-4.4	N.S
25	0-20	Clay	7.7	8.80	11.76	10.93	-30.7	S
	20-40	Clay	7.7	3.93	12.16	2.57	-17.9	N.S.S
	40-60	Clay	7.9	4.34	13.10	6.50	-17.8	S
	60-80	Clay	7.7	3.33	14.64	7.73	-9.0	N.S

Suggestions: It is suggested that the saline soils of the study area can be improved by leaching soluble salts from the root zone with first class ($C_1S_1R_1$) irrigation water, Saline-sodic and Non-saline sodic soils can be reclaimed first by applying gypsum and then by leaching with good quality irrigation water. Introduction of biosaline agriculture, especially salt-tolerant crop varieties can be used to utilize these soils.

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