Agricultural Journal 7 (2): 128-134, 2012
ISSN: 1816-9155

Study of Relationship Between Water Table and Soil Degradation in Sharda Sahayak Canal Command in Barabanki District, Uttar Pradesh, India

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Abstract: Canal irrigation was taken up as one of the most important way to irrigate crops in seasons when there is scarcity of water. The study area is under dense network of Sharda Sahayak canal which was commenced in 1972. The major areas in this canal command are now facing the problems of water logging and secondary salinity. The areas in the close vicinity of canal are permanently water logged. Most of the areas in close vicinity of main feeder canal are water submerged due to seepage from the canal and as we move away from the canal water table depth increases. The water table data is correlated with soil data for parameters like pH, EC, ESP, SAR and ESC. It shows that soil samples from the areas in close proximity of the canal have water table <3 mbgl (meters belowground level) have pH>10, Sodium Adsorption Ratio (SAR) >18 and Exchangeable Sodium Percentage (ESP) >20 is in the category of sodic land according to USDA classification. The locations away from the main canal have water table >5 mbgl have normal soil categorization with pH (7-9), SAR (<15) and ESP (<18). Soil profile data of all the parameters (EC, pH, soil texture, ESP, SAR) decreases with the depth profile indicating salts enrichment is pronounced in upper layer. Development of secondary salinity through capillary action due to evaporation is clearly indicated. Chemical analysis of the water samples are well within the permissible range of different cations and anions required for irrigation purpose. The problem of sodicity is not due to the inherent chemical nature of the water but developed by capillary action of water in the soil (through physical process).

Key words: Waterlogged, secondary salinity, cations, soil profile, sodium adsorption ratio, parameters

INTRODUCTION

India is one of the few countries where modern large scale irrigation projects were implemented in the beginning of mid 20th century but these surface irrigation projects have created a huge impact on environmental aspect of the terrain and the consequent socio-economic status of the people. The introduction of irrigated agriculture, however in arid and semi-arid regions of the country has resulted in the development of the twin problem of water logging and soil salinization with considerable areas either going out of production or experiencing reduced yield.

Over irrigation from canal water along with inadequate water management practices further aggravates the situation which gives rise to water logging (ASCE, 1990). In canal command areas, farmers may not be able to control irrigation with excess water table (Minhas *et al*., 1990). Water logging in low lying areas is created by seepage from canal water systems. When water table rises up to 5-6 feet of the soil surface, ground water moves upward in to the root zone and to the soil surface. Under such conditions, ground water as well as irrigation water contributes to salinization of the soil. For agricultural purposes such soils are regarded as problem soil and it requires special remedial measures and management practices (Rai, 2007). The fertile land is seriously affected when water table rises into the root zone of the plant/crop. The excessive and indiscriminate use of surface/canal water has led to regional environmental imbalances which caused water logging and soil infertility in irrigated commands (Gupta, 1990). The water in excess, adversely affects the production and yield of crops by reducing soil volume accessible to their roots and excessive soil moisture prevents the formation of carbon dioxide by plant roots and other organisms (Ayers and Westcot, 1985). When excess soluble salts accumulate in these soils, sodium frequently becomes the

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dominant cation in the soil solution (Shakya, 2005). In the process, the salt is left behind in the soil, since the amount taken up by plants and removed at harvest is quite negligible. The more arid the region, the larger is the quantity of irrigation water and consequently, the salts applied and the smaller is the quantity of rainfall that is available to leach away the accumulating salts (Gupta, 1990).

The amount of salt which accumulates is further influenced by the water table depth, the capillary characteristic, so the soil and the management decisions regarding the amount of water applied in excess saline ground water levels. When the water table approaches, the bottom of the root zone, capillary action results in the salinization of the root zone and the surface soil of plant evapo-transpiration leach the salt away (Sharma, 2007). Alkalinity is the degree of alkalinity in soil, expressed by a value of soil pH>7 (Singh, 1997).

When ground water level is close to the surface of soil then upward movement of the water to the soil surface takes place and this leads to serious salinity problems and problem intensified when the content of salt in ground water is high. In this condition, evaporation of water leave the salts on the soil surface (Sharma, 2007). The micro relief is an important controlling factor in water flow through the vadose zone. Climate, soil properties and depth of salinity in soil profile all together are responsible for productivity (Statistical Diary, 2006). The degree of soil salinization is a result of interaction between rising water table and natural concentration of salt in the soil as shallow water table rises towards the surface, evaporation occurs and surface soil salinity results. The capillary fringe separates the unsaturated zone from the underlying saturated zone, the ground water table is the level that water stand in a bore hole and the saturated zone below the water table extends to depths reached by interconnected openings (Choubey, 1998). Vadose or saturated zone is that region of the shallow subsurface bounded on top by the earth's surface and on the bottom by the water table (Mukherjee *et al*., 2006). It is also called zone of aeration it is water lying between the surface of the ground and the water table (Wilcox, 1948). It is in part held in the form of film by soil particles. It includes the root zone, intermediate zone and capillary fringe and the pore space (Wildman, 1982). The zone immediately above the water table where water is drawn upward by capillary attraction is called capillary fringe (World Bank Report, 2000).

Most of the irrigation in Barabanki district is covered through Sharda Sahayak canal system. This is actually the expanded scheme of the original Sharda canal system as the previous network was insufficient to irrigate entire command area, particularly downstream, i.e., East of Lucknow (Barabanki district). Soluble salts produce harmful effects to plant by increasing the salt content of the soil solution and by increasing the degree of saturation of the exchange materials in the soil with exchangeable sodium (Sharma, 2007). The present study is taken up to study relationship between water logging from canal seepage and its impact on land degradation in Barabanki district where most of the agricultural land is getting degraded and converted to infertile land.

MATERIALS AND METHODS

Study area: The study area Barabanki district shown in Fig. 1 constitutes a part of central Uttar Pradesh and lies between 26°32' and 27°21'N latitudes and between 80°05' and 81°51'E longitudes. The district is bounded by River Ghaghra in the North and River Gomti in the South. Water table and soil sample data is collected from different location around main Sharda Sahayak feeder canal. The water table and soil data is collected at 20 different locations (Fig. 1).

Sample collection and analysis: The soil and water samples were collected from different locations. Random sampling was done in the study area and location of sample points were determined on the basis of satellite imagery and SOI toposheets data. Soil samples were taken from different soil horizons from the pits of 1.5 m depth, i.e., 0-10 cm (apical region), 10-60 (middle region), 60-90 (lower middle region) 90-120 (distal region). GPS was used to register the point co-ordinates. Finally all the samples were analyzed in the laboratory for EC, PH, ESP (Exchangeable Sodium Percentage), SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate) and water soluble salts. The water table data was collected from dug wells in the areas and also water samples were collected. Soils are air dried at 20-25°C and with relative humidity of 20-60% (Jackson, 1979). Large lumps of moist soil are broken by hand and spread on paper in a room. After air drying, the soil is ground by using pestle and mortar then air dried soil is passed to 2 mm sieve using modified RuKuhia soil grinder.

Gravel and organic residue is removed. Soil and sediment samples are typically sieved through a -80 mesh (180 μ) screen and the fine fraction is retained for analysis. Soil sample may undergo significant changes during storage (air dried), particularly with respect to extractable nutrient concentrations (Maynard *et al*., 1987; Searle and Sparling, 1987). As a result, many extractable analysis are carried out on most samples and therefore, the soil are stored air dried until the analysis can be performed.

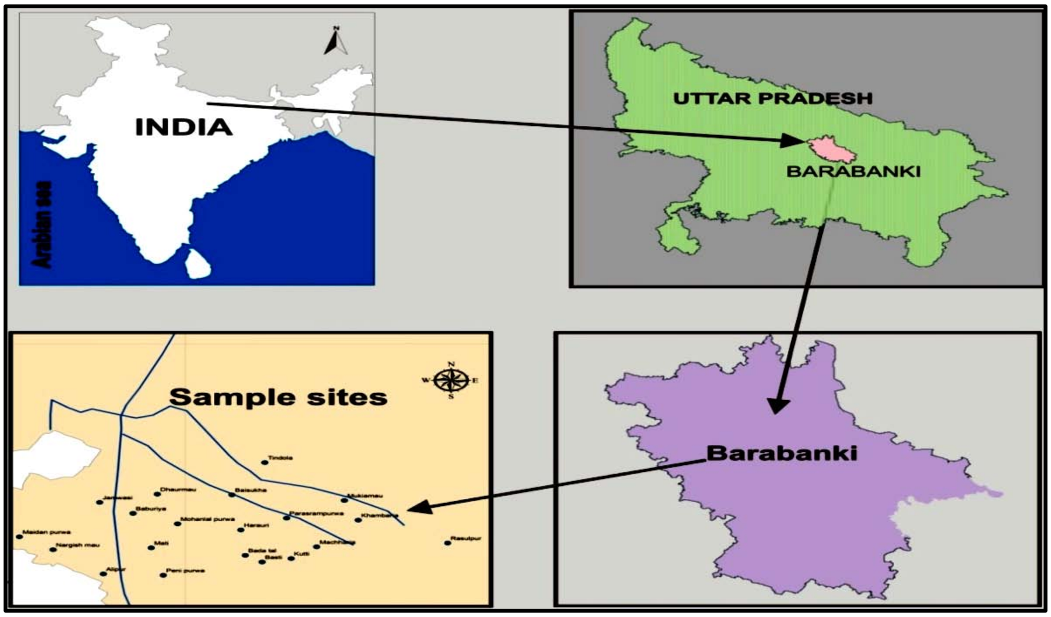

Fig. 1: Study area of Barbanki district, Utter Pradesh, India

The sample must be mixed well before a sample weighed for analysis. Soil samples were analyzed for different parameters like pH (Jackson, 1979). EC (Rhoades, 1996). Sodium Adsorption Ratio (SAR) = $[Na+]/\sqrt{[Ca^{++}+Mg^{++}]/2}$ (Richards, 1954), Exchangeable Sodium Percentage (ESP) = (Y/(1+y)*100 where, y = (0.01475 SAR) - 0.0126 (Rhoads, 1996), RSC (Residual Sodium Carbonate) (Eaton).

RESULTS AND DISCUSSION

The water table data collected from the open dugwells in study area (Table 1) shows that the areas near the canal has shallow water table due to seepage from the canal but as we move away from main canal the water table becomes deeper and deeper.

Water table data (Table 1) of the study area shows that major areas around the canal are permanently water logged with water depth varying from few cm to 1.5 m. The area around canal has very shallow water table which is making agriculture in these areas difficult. The soil sample taken from different profile at different location in summer season (Table 2-13) also shows higher values of pH mostly >10 and high values of Sodium Adsorption Ratio (SAR) >18 and Exchangeable Sodium Percentage (ESP) >20 which according to USDA classification falls under the category of sodic land. The samples taken from the areas away from the main canal having water table >5 are under normal soil categorization as their pH values are between 7-9 and SAR and ESP values are <15 and 18, respectively (Table 14-21). The correlation data (Fig. 2) between SAR and pH is showing high degree of correlation. In the areas where water table is <3 mbgl. The extent of degraded lands is high to very high varying from 15-30% barren lands including usar (sodic), waste and fallow lands in area. The soil profile data in Table 2-21 shows that as we move up in the profile the values of different parameters is increasing which clearly indicates that sodicity is not due to inherent nature of the soil in the region but is developing by accumulation of salts in the root zone through evatotranspiration.

Table 1: Water table data at different location in canal command taken from dugwells

Areas	Geographical location	Water level (m)
Alipur	26°55'47.8"; 81°03'59.5"	3.70
Mati	26°03'52.0"; 81°04'36.2"	2.32
Mohan Lal Purwa	26°56'44.5"; 81°04'49.7"	2.46
Harauri	26°56'35.5"; 81°05'36.5"	3.70
Basti	26°56'8.5"; 81°05'39.6"	2.86
Kutti	26° 56' 0.3"; 81°05'41.2"	4.20
Machharia	26° 56'19.2"; 81° 06'28.6"	3.82
Khambharia	26°56'51.7"; 81°7'10.4"	5.70
Mukaiamau	26°57'7.5"; 81°7'10.4"	5.60
Parasrampur	26°57'21.4"; 81°07'19.4"	5.10
Tindola	26°58'0.8"; 81°06'2.6"	3.03
Baisakha	26°57'55.2"; 81°05'2.3"	3.10
Badatal	26°57'55.2"; 81°05'2.4"	2.80
Dhaurmau	26°57'17.3";81°04'28.7"	3.00
Baburiah	26°56'59. 6"; 81°04'10.6"	1.00
Jamwasi	26°57'13.9"; 81°03'56.0"	2.00
Maidanpurwa	26°57'16.9"; 81°03'56.0"	3.02
Peni purwa	26°57'15.9"; 81°04'52.0"	3.50
Rasulpur	26°57'14.9";81°03'59.0"	4.01
Nargishmau	26°57'12.9"; 81°04'56.0"	5.00

Table 2: Chemical analysis of soil of Alipur (26°55'47.8"N/81°03'59.5"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	M (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.5	1.62	4.0	0.6	33.05	0.59	21.79252	18.26	66.88
15-30	10.5	1.52	4.2	1.1	32.10	0.59	19.71887	17.39	66.72
30-60	10.2	1.44	4.5	0.7	31.33	0.51	19.43004	17.39	59.98
60-90	10.0	1.42	3.5	1.8	31.55	0.41	19.38101	13.04	47.65
90-120	9.7	1.01	3.2	0.4	25.88	0.41	19.28981	11.30	35.02

Table 3: Chemical analysis of soil of Mati (26°03'52.0"N/81°04'36.2"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	N (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.4	3.10	3.9	0.8	33.45	0.59	21.82037	18.26	66.92
15-30	10.2	2.87	3.5	1.2	32.78	0.59	21.38331	17.39	66.72
30-60	10.2	2.33	3.4	0.9	30.80	0.51	21.00543	17.39	59.98
60-90	9.8	1.75	3.5	0.2	27.88	0.41	20.49778	13.04	47.65
90-120	9.7	1.52	3.2	0.4	25.44	0.41	18.96186	11.30	35.02

Table 4: Chemical analysis of soil of Mohan Lal Purwa (26°56'44.5"N/81°04'49.7"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	8.7	0.73	6.8	0.4	32.88	0.33	17.32928	11.30	13.85
15-30	8.7	0.64	6.0	2.6	31.66	0.36	15.26781	10.43	13.29
30-60	8.5	0.61	5.9	1.8	30.48	0.36	15.53405	9.57	12.99
60-90	8.3	0.53	5.7	1.2	27.86	0.36	14.99932	9.57	12.11
90-120	8.1	0.36	5.2	1.2	25.34	0.31	14.16549	6.96	12.10

Table 5: Chemical analysis of soil of Harauri (26°56'35.5"N/81°05'36.5"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	9.3	0.43	3.2	2.8	30.99	0.10	17.89208	21.74	20.71
15-30	9.2	0.32	3.1	2.7	30.22	0.05	17.74580	25.22	15.01
30-60	9.2	0.65	3.0	2.6	28.95	0.08	17.30093	17.39	15.00
60-90	8.3	0.66	2.8	2.5	27.88	0.08	17.12655	19.13	13.56
90-120	8.1	0.66	2.5	2.0	23.56	0.05	15.70667	12.17	13.25

Table 6: Chemical analysis of soil of Basti (26°56'8.5"N/81°05'36.5"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.3	0.43	2.4	1.9	33.45	0.10	22.81271	17.39	66.92
15-30	10.2	0.32	2.3	1.7	31.45	0.08	22.23851	16.96	66.72
30-60	10.2	0.65	1.4	3.0	30.80	0.08	20.76536	16.52	58.88
60-90	10.0	0.66	7.8	2.8	27.88	0.08	12.11030	16.09	47.65
90-120	9.1	0.66	3.4	2.8	25.44	0.05	14.44895	12.16	35.26

Table 7: Chemical analysis of Kutti (26°56'0.3 N/81°05'36.5"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.4	1.37	3.5	0.9	33.45	0.13	22.55199	18.26	68.40
15-30	10.3	1.27	3.2	0.8	31.88	0.18	22.54256	17.39	35.18
30-60	10.2	1.26	3.0	0.8	31.00	0.18	22.48976	16.52	28.76
60-90	9.8	0.92	2.8	0.6	28.66	0.15	21.98122	14.78	15.53
90-120	9.4	0.58	2.5	0.4	26.15	0.13	21.71639	13.91	12.87

Table 8: Chemical analysis of Machharia (26°56'19.2"N/81°06'28.6"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.5	1.07	3.2	0.9	33.47	0.18	23.37646	16.22	68.40
15-30	10.2	1.22	3.1	0.7	31.42	0.18	22.79446	14.79	52.98
30-60	10.1	2.31	3.0	0.7	29.98	0.23	22.04173	14.78	50.04
60-90	10.1	2.99	2.7	0.6	27.88	0.21	21.70455	14.78	23.55
90-120	9.7	2.82	2.6	0.3	23.44	0.15	19.46586	13.91	23.55

Table 9: Chemical analysis of soil of Khambharia (26°56'51.7"N/81°7'10.4"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	8.9	0.18	3.2	1.70	25.12	0.13	16.04858	20.00	13.85
15-30	8.8	0.14	2.8	1.55	23.20	0.15	15.73107	19.13	13.49
30-60	8.8	0.19	2.5	1.30	21.30	0.18	15.45264	19.13	12.79
60-90	8.8	0.19	2.5	1.10	20.15	0.10	15.01892	16.52	12.52
90-120	8.4	0.19	2.3	0.80	18.23	0.13	14.64269	15.65	12.14

The problem of water logging and uprising of water table in nearby areas of the canal is due to seepage from canal. Though, lining of canals can reduce seepage of water up to some extent but the quality of linining is not proper and it is done only with main canals, distributaries and minors are still not lined. So, the seepage from the

Table 10: Chemical analysis of soil of Mukiamau (26°57'7.5"N/81°7'10.4"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.7	0.52	3.20	0.4	33.47	0.54	24.94707	13.04	68.25
15-30	10.5	1.02	3.10	0.2	31.42	0.31	24.46044	10.43	66.22
30-60	10.3	1.40	2.90	0.4	29.98	0.26	23.33940	8.70	60.00
60-90	10.2	1.96	2.40	0.6	27.88	0.28	22.76392	8.70	50.05
90-120	10.0	2.14	2.22	0.6	23.44	0.28	19.74004	7.83	26.69

Table 11: Chemical analysis of soil of Parasrampurwa (26°57'21.4"N/81°07'19.4"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	9.1	0.59	3.8	3.4	25.12	0.10	13.23940	15.65	12.16
15-30	8.6	0.60	3.2	3.3	23.20	0.13	12.86904	14.78	11.77
30-60	8.5	0.60	3.1	3.3	21.30	0.13	11.90706	13.04	11.02
60-90	8.5	0.26	3.0	3.1	20.15	0.10	11.53786	12.17	9.46
90-120	8.0	0.68	3.0	2.9	18.23	0.10	10.61392	12.61	5.98

Table 12: Chemical analysis of soil of Tindola (26°58'0.8"N/81°06'2.6"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	8.9	0.23	4.90	2.2	25.11	0.13	13.32700	17.39	13.78
15-30	8.8	0.18	4.80	1.9	23.18	0.15	12.66459	17.39	13.55
30-60	8.7	0.20	4.80	1.9	21.27	0.13	11.62104	17.39	12.86
60-90	8.1	0.20	4.32	1.8	20.17	0.13	11.53042	16.52	12.30
90-120	8.0	0.39	4.20	1.4	18.21	0.18	10.88256	15.65	12.14

Table 13: Chemical analysis of soil of Baiskha (26°57'55.2"N/81°05'2.3"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.2	0.96	3.2	1.8	27.88	0.31	17.63286	13.91	68.40
15-30	9.9	0.58	3.1	1.6	25.11	0.36	16.37996	10.43	52.98
30-60	9.7	0.35	3.0	1.4	23.78	0.26	16.03247	9.57	50.04
60-90	9.7	0.32	2.8	1.1	22.18	0.18	15.88343	9.57	23.55
90-120	9.6	0.29	2.7	1.1	21.27	0.18	15.43088	9.57	23.55

Table 14: Chemical analysis of soil of Badatal (26°57'55.2"N/81°05'2.4"E)

Soil depth (cm)	pH	EC (S m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	9.9	0.51	3.1	1.20	25.11	0.09	17.12488	23.91	20.71
15-30	9.8	0.66	2.9	1.10	23.78	3.08	16.81500	23.47	15.01
30-60	9.7	0.72	2.6	1.10	22.18	2.82	16.30706	22.60	15.00
60-90	9.6	0.26	2.4	1.10	21.27	7.18	16.07861	20.43	13.56
90-120	9.4	0.51	2.1	0.98	19.88	3.59	16.01976	20.00	13.25

Table 15: Chemical analysis of soil of Dhaurmau (26°57'17.3"N/81°04'28.7"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.8	1.94	3.5	1.6	33.12	0.36	20.74055	23.91	59.07
15-30	10.8	3.05	3.4	1.3	31.54	0.38	20.57443	23.04	43.62
30-60	10.8	2.46	3.2	1.2	30.15	0.41	20.32713	22.60	41.49
60-90	10.7	2.21	3.0	0.9	28.15	0.38	20.15863	20.43	34.65
90-120	10.7	2.40	3.0	0.8	27.77	0.36	20.14648	19.13	25.94

Table 16: Chemical analysis of soil of Baburiah (26°56'59.6"N/81°04'10.6"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.6	0.64	3.2	0.9	33.47	1.54	23.37646	19.13	58.74
15-30	10.4	0.67	3.1	0.7	31.42	1.03	22.79446	15.65	47.77
30-60	10.2	0.85	3.1	0.7	29.98	1.54	21.74978	15.65	41.03
60-90	10.2	1.22	3.0	0.6	27.88	1.54	20.78053	13.91	37.80
90-120	10.0	1.53	3.0	0.5	23.44	2.56	17.71897	10.43	28.38

Table 17: Chemical analysis of soil of Jamwasi (26°57'13.9"N/81°03'56.0"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	7.8	0.09	3.6	4.6	25.11	0.13	12.400950	10.43	12.15
15-30	7.7	0.08	4.8	4.2	23.18	0.13	10.927160	8.70	12.01
30-60	7.5	0.07	4.6	4.1	21.27	0.15	10.198180	7.83	11.86
60-90	7.5	0.13	4.4	3.9	20.17	0.18	9.901064	7.83	11.30
90-120	7.4	0.09	3.8	3.7	18.21	0.10	9.403604	6.52	11.20

canal in these areas has not been reduced to a marked level even after lining and the water logged areas in canal commands are still increasing. In Sharda Sahayak canal command, the fine texture of soil and poor drainage result

Table 18: Chemical analysis of soil of Maidanpurwa (26°57'16.9"N/81°03'56.0"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	9.9	0.27	3.0	1.20	25.22	0.21	17.40345	21.73	50.04
15-30	9.8	0.23	2.8	1.10	23.68	0.18	16.95760	21.73	35.02
30-60	9.3	0.34	2.6	1.10	22.28	0.15	16.38058	17.30	20.11
60-90	9.1	0.79	2.5	1.10	21.37	0.15	15.92826	13.91	19.63
90-120	8.7	0.90	2.3	0.98	19.78	0.13	15.44559	10.87	16.21

Table 19: Chemical analysis of soil of Penipurwa (26°57'15.9"N/81°04'52.0"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.6	0.56	3.3	1.0	31.37	0.18	21.39416	24.34	28.48
15-30	10.5	0.95	3.2	0.8	29.42	0.21	20.80308	22.60	18.10
30-60	10.5	1.22	3.2	0.8	27.98	0.18	19.78485	18.26	15.02
60-90	10.2	1.34	3.1	0.7	26.33	0.10	19.10179	17.39	15.01
90-120	10.1	1.17	2.9	0.6	24.44	0.10	18.47490	15.65	14.30

Table 20:Chemical analysis of soil of Rasulpur (26°57'14.9"N/81°03'59.0"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	10.1	0.31	3.2	1.8	30.88	0.15	19.53023	20.83	52.00
15-30	10.0	0.53	3.1	1.6	25.22	0.21	16.45171	19.13	35.66
30-60	9.9	0.62	3.0	1.4	23.68	0.18	15.96505	12.17	34.23
60-90	9.9	0.72	2.8	1.1	22.28	0.21	15.95504	10.43	25.16
90-120	9.1	0.79	2.7	1.1	21.27	0.18	15.43088	10.00	24.12

Table 21: Chemical analysis of soil of Nargishmau (26°57'12.9"N/81°04'56.0"E)

Soil depth (cm)	pH	EC (dS m^{-1})	Ca (meq L^{-1})	Mg (meq L^{-1})	Na (meq L^{-1})	K (meq L^{-1})	SAR	CEC	ESP
0-15	9.9	0.32	3.1	1.20	25.22	0.18	17.19990	11.30	33.58
15-30	9.9	0.54	2.9	1.10	23.68	0.23	16.74429	11.30	33.37
30-60	9.8	0.68	2.7	1.10	22.28	0.23	16.16361	10.87	30.87
60-90	9.7	0.55	2.7	1.10	21.37	0.21	15.50343	10.43	26.90
90-120	8.7	0.39	2.4	0.98	19.78	0.15	15.21538	10.43	13.89

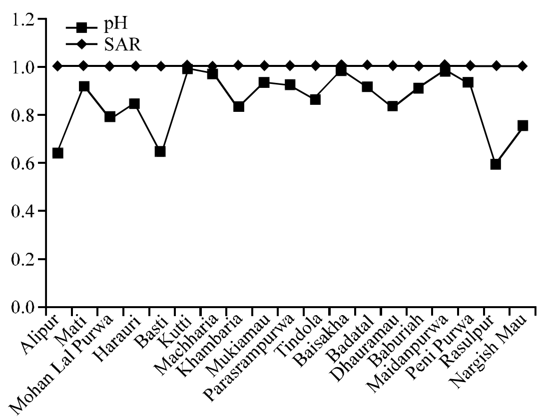

Fig. 2: Corelation coefficient graph of pH and SAR (Sodium Adsorption Ratio)

in slow movement of water through soil. The porous material reacts and chemical interchanges take place to form Reh on the soil surface and to increase the concentration of chemical constituents in the ground water.

In addition to this these areas have extensively mono-cropped and double cropped sodic lands with poor to very poor productivity. Current and other fallow lands are high because of wide extensive submergence in monsoon months and high soil humidity in rabi sowing months.

CONCLUSION

Canal irrigation in India has been marked by a number of inequities. In India planners have taken irrigation, mechanically as a way to large scale storage and transfer of water without talking into consideration the actual needs of society, soil characteristics and cropping pattern. The basic reason for the water logging of the canal commands is that the drainage aspect has not been given proper attention in irrigation commands.

The study was done to show that the degradation of land in Sharda Shayak canal command is due to rise in ground water table by seepage from canal which is responsible for accumulation of different water soluble salts in the root zone. Most surface irrigation and drainage infrastructure in the district is in a severe state of disrepair and is in urgent need of maintenance. The problems are due poor design and construction quality but the major problem is the cumulative effects of poor maintenance.

Canals and drains are heavily silted and the structures are eroded and collapsed, limiting the capabilities of the irrigation and drainage systems. Poor maintenance of irrigation facilities has severely reduced irrigation efficiency, leading to excessive irrigation in head reaches and low or negligible irrigation in tail reaches.

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