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QUALITY PARAMETERS OF IRRIGATION WATER IN SOME MINOR LIFT IRRIGATION SCHEMES AND THEIR IMPACT ON PHYSICO-CHEMICAL PROPERTIES AND NUTRIENT STATUS OF SOILS

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Due to increasing demand of water for various purposes, use of poor quality water for irrigation and consequently its judicious management, becomes inevitable in certain regions. Sometimes poor quality water is the only available source for irrigation. There are twelve minor lift irrigation schemes in operation in the fringe areas of Ranvir canal command, south of Jammu city, some of them on perennial nallahs which are fed partly by municipal waste water or industrial effluents and partly by seepage/ drainage from higher elevation and some of them on distributaries of Ranvir canal, catering to irrigation needs of agricultural land of 35 to 100 ha of each for the past two decades. Though, irrigation needs of agriculture originally help to harvest bumper crop, it increases soil salinity and has other deleterious effect on soil characteristics. There is a general decline in crop yield under aforesaid minor lift irrigation schemes. In view of this, present investigation was undertaken.

The study area comprising two minor lift schemes, one on "Bhor" nallah fed mainly by municipal wastes for the past two decades and industrial effluents for the past one decade having cultural command area about 38 ha and the other at Chatha farm area beyond the confluence of Bhor and Balol nallahs, but mainly fed by industrial effluents from the industrial areas having cultural command areas of about 60 ha have been identified for the study. In addition, a third minor lift scheme at Gidergalian, lifting good quality irrigation water from distributory No. 10 on Ranvir canal and feeding about 100 ha of fringe area beyond the cultural command area of the distributory command has also been chosen for comparison, during 2000-05. Climatic zone of study area is low altitude subtropical zone, with an average rainfall of 1260 mm, two third of which is in the *kharif* months of July, August and September. The atmospheric temperature ranges from 0 to 40 ^{o}C. surface soil texture ranges from sandy loam to silt loam and profile generally homogeneous upto 2 m depth. Irrigation water samples in monthly frequency at the take off points as well as at mid section and tailend of command of all these three schemes were collected and analyzed for standard water quality parameters by following standard methods (USS Staff, 1954) at water quality laboratory of National Institute of Hydrology, Western Himalayan Region Centre, Jammu. The quality parameters analyzed were pH, EC, SAR, MH and RSC. The soil samples from these concerned command and adjoining areas of non command were also collected and analyzed for important physico-chemical properties and available N, P and K of status by following standard method (Jackson, 1978).

The results pertaining to water quality indicates that pH values in all the water samples lie with in the safe range of pH 6.5 to 8.5 except in a couple of samples viz. at Chatha-2 (8.98) and Chatha-3 (8.68) which corresponds to non-rainy lean period with higher concentration of non effluents in water of Chatha LIS. The electrical conductivity of all the three sites ranged from 0.458 to 4.925 with mean value of 1.491, 0.497-1.551 with mean value of 1.027 and 0.209-0.552 with mean value of 0.306 ds/m at Bhor, Chatha and Gidergalian respectively (Table 1). Electrical conductivity also varied with different time intervals. The values were higher in the months of January and February and lower in the months of September at all the locations. The increasing salinity in irrigation water of about 85% samples at Bhor LIS, 76% samples at Chatha LIS and 7% at Gidergalian LIS,

respectively. The levels of salinity at Bhor LIS and Chatha might be due to intake of municipal cum industrial waste water. The SAT values of water samples ranged from 0.41 to 0.44 with mean value of 0.83, 0.17 to 1.11 with average value of 0.59 and 0.10 to 0.44 with mean value of 0.16 at Bhor, Chatha and Gidergalian, respectively. As values of SAR fall below the prescribed limit of 10.0, irrigation water of all the study sites could be classified as in excellent category. The magnesium hazards (MH) ranged from 24 to 65 with mean value of 46, 34 and 89 with mean value of 58 and 23-72 with mean value of 48 me/l at Bhor, Chatha and Gidergalian, respectively. The effect of magnesium hazards are considered to be harmful, where MH > 50 me/l (Pitchaiah, 1975). In this study, majority of water samples (65%) collected from municipal cum industrial waste water used for irrigation at Chatha LIS lie under the harmful class of magnesium hazards. The values of residual sodium carbonate ranged from 0.24 to 2.96 with average of 1.32, 0.22-3.32 with mean value of 1.08 and 0.01-1.98 with mean value of 0.62 me/l at Bhor, Chatha and Giderfgalian, respectively. In this study majority of water samples from all the sites lie under the safe category as per the limit of RSC < 1.25 me/l as proposed by Eaton (1950).

The soil texture of all the four sites varied from sandy loam to silt loam. The silt loam texture of majority of soil samples at Gidergalian and Dharap might be due to heavy siltation in soils through irrigation water of Ranvir canal. Whereas sandy clay loam texture was noted in non command areas of these two locations owing to use of silt free ground water for irrigation. The soil pH of all the four locations varies from 6.5 to 7.5. In general, the values were higher at Bhor and Chatha soils as compared to Gidergalain and Dharap. It might be due to use municipal cum industrial waste water at Bhor and Chatha. The pH values of soils of non command areas were higher than the command areas. It might be due to moisture stress in non command soils resulting in OH ions on soil surface in non commands soils. The surface soils showed higher value of pH over subsurface soils. In general EC values of soils of command were higher over the soils of non command. The EC

Table 1. Irrigation water quality parameters of study areas

Sampling date	Bhor Camp				Chatha				Gidargalian			
	EC	SAR	MH	RSC	EC	SAR	MH	RSC	EC	SAR	MH	RSC
17-01-00	1.701	0.82	39	2.47	1.213	0.48	34	0.71	0.552	0.13	72	0.74
18-02-00	1.543	0.91	46	1.47	1.248	0.47	63	0.54	0.524	0.15	65	0.81
30-03-00	1.812	0.37	45	1.81	1.160	0.17	89	1.42	0.415	0.11	52	0.98
08-05-00	1.914	0.41	46	0.74	1.202	0.16	87	0.22	0.306	0.10	45	1.98
08-06-00	1.567	0.81	59	2.96	0.955	0.41	70	3.32	0.031	0.11	50	0.01
17-07-00	1.430	0.64	65	1.24	0.900	1.06	46	1.80	0.214	0.13	23	0.38
21-08-00	1.430	1.08	47	0.08	0.895	0.70	61	0.29	0.295	0.11	36	0.27
26-09-00	0.458	0.54	41	0.98	0.417	0.64	38	0.76	0.209	0.16	39	0.45
03-11-00	0.516	1.53	24	0.90	0.592	1.11	50	0.72	0.320	0.44	34	0.05
21-12-00	1.805	0.79	56	1.67	1.551	0.67	45	0.65	0.422	0.19	61	0.59
27-02-01	1.925	1.29	38	0.24	1.163	0.67	50	1.50	-	-	-	-

Table 2. Soil characteristics and available nutrients status of command vs non command

Locations	Soil Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Textural Class	pH	EC ds/m	OC %	N	P_2O_5 kg/ha	K_2O kg/ha
Bhor Camp											
Command	0-22.5	62	25	13	Sandy	7.3	0.79	0.75	618	26.5	315
	22.5-45	59	26	15	loam	7.0	0.72	0.52	412	19.2	185
Non Command	0-22.5	58	24	16	Sandy	6.8	0.52	0.58	516	20.1	213
	22.5-45	56	25	17	loam	6.5	0.41	0.42	338	16.5	152
Chatha											
Command	0-22.5	63	22	15	Sandy	7.2	0.65	0.60	482	20.0	204
	22.5-45	61	23	16	loam	7.0	0.62	0.40	311	17.5	141
Non Command	0-22.5	60	21	18	Sandy	6.8	0.42	0.52	355	18.0	158
	22.5-45	58	20	10	loam	6.6	0.41	0.40	218	15.5	110
Gidergalian											
Command	0-22.5	39	48	09	Silt	6.4	0.41	0.45	182	14.0	185
	22.5-45	40	51	10	loam	6.7	0.51	0.22	108	10.2	218
Non Command	0-22.5	60	19	21	Sandy	7.2	0.22	0.55	438	23.0	165
	22.5-45	58	21	20	loam	7.0	0.20	0.38	228	15.0	138
Dharap											
Command	0-22.5	38	58	08	Silt	6.5	0.35	0.42	185	12.5	215
	22.5-45	36	52	10	loam	6.6	0.41	0.29	112	11.0	285
Non Command	0-22.5	57	22	19	SL	7.5	0.18	0.52	358	21.2	142
	22.5-45	55	21	20	Sandy CL	7.3	0.15	0.41	122	16.0	118

values of Bhor and Chatha soils of command were higher than the soils of Gidergalian and Dharap. Surface soils of Bhor and Chatha showed higher values of EC than the subsurface soils whereas opposite trend was noted in soils of Gidergalian and Dharap. The surface soils showed higher content of organic carbon in comparison to subsurface soils. The values of OC were higher in soils of Bhor and Chatha when compared with Gidergalian and Dharap. The higher content of organic carbon was noted in soils of non command over command at Dharap and Gidergalian whereas reverse trend in organic carbon distribution was observed in soils of Bhor and Chatha. The higher content of available N and P_2O_5 was recorded in surface soils over subsurface soils. The soils of command areas showed higher content of available N and P_2O_5 as compared to non command at Bhor and Chatha, whereas a reverse trend was observed in soils of Gidergalian and Dharap. The available K_2O content in general was higher in soils of Bhor followed by Chatha, Gidergalian and Dharap. The soils of command areas showed higher content of K_2O over non command at Chatha and Bhor, whereas opposite trend was found in available K_2O content at Gidergalian and Dharap. The increasing levels of available K in sub soils of Gidergalian and Dharap might be due to leaching of K in light textured soils.

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