

## Response of Salts in Saline Soil Using Different Irrigation Scheduling in Semi-Arid Zone of Pakistan

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**Abstract.** The salinity of soil is a crucial challenge for growers irrigating in semi-arid zones. To accomplish salinity, growers require information about salt's basis and processes of the salt mobility through the root zone. Soil salinity can be managed by exceptional irrigating farming practices including irrigation scheduling to leach down salts through the root zone. This study aimed at examining the salts movement in saline soil in a semi-arid region in Sindh, Pakistan. This field experiment was conducted during the summer of 2017 on a salt-affected land by using three irrigation treatments of canal water including T1 (7 day irrigation interval), T2 (14 day irrigation interval) and T3 (21 days irrigation interval) under 10, 9 and 8 cm depths of irrigation water, respectively. The texture of soil was silty clay loam having an electrical conductivity (EC) ranging from 7.73 to 20.69 dS/m. However, the pH of the soil ranged from 7.89 to 8.04. The findings of a two-way analysis of variance were consistent with the statistical examination of EC and pH data day-wise (7, 14 and 21 days) and depths-wise (10, 9 and 8 cm). Average reductions in the EC and pH of the soil were observed at 7 days interval and 10cm depth at  $P < 0.05$ . Overall, the findings exhibited that, compared to the 14 and 21 day intervals, a 7 day irrigation interval was more effective in terms of salt leaching from the soil profile.

**Keywords:** canal water, irrigation scheduling, root zone, soil salinity

### Introduction

The soil salinity has been recognized as a chief risk for sustainable agriculture particularly in arid and semi-arid area (Wang *et al.*, 2008). Salinity is a rigorous threat which not only decreases crop yield but also generates severe effects on the livelihood of agricultural growers (Ziaul and Zaber, 2013).

Saline soils cover 9 million km<sup>2</sup> of the land surface of the earth (FAO, 2005) and globally around 40% of the land area is impacted by high salinity which can be utilized for agricultural production (Cui *et al.*, 2018; Lal, 2009).

Salinity problems arise with changes in the concentration of salt in irrigation water (Koç, 2008). Though, there are some instances of salt-impacted soils in locations starting from tropical environments to locations amidst

the polar circle (Schofield *et al.*, 2001). Soil salinization happens due to numerous reasons involving increasing temperature and reduced precipitation (Ghafoor *et al.*, 2004). Therefore, farmers are unable to afford agricultural practices (Rashid *et al.*, 2004; Ashraf and Sarwar, 2002).

Effective desalinization of salt-affected soils requires a down motion of salt buildup area to a depth from where desalinization is extremely restricted. If the level of groundwater level is lower, the salt accumulation area travels down to a significant depth with adequate rainfall that is beyond the evapotranspiration of agricultural land (Monteleone and Libutti, 2012). Though, due to high evaporation, shallow groundwater makes salt buildup area hard to move downwards. The agricultural productivity in salt effected soil can be improved through salts leaching by irrigation applications (Hussain *et al.*, 2016). Many countries including Australia, China, India, Mexico, Turkey, and Pakistan

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are also encountering salt-related agricultural issues (Rhoades, 1998).

Being an agricultural country, the land of Pakistan is irrigated by river Indus and its branches propose a chance to cultivate several types of crops under diverse environments. The crop yield has been deteriorating for last three decades, nevertheless, this reduction during recent years has been significant due to salinity which considered a key issue of agriculture. Research indicated that from total of 79.6 Mha land area, about 6.3 Mha is troubled by salinity in Pakistan (Khan, 1993). Around 5.1 Mha area of Sindh is affected by salinity. From this area, almost 3.23 Mha and 1.87 Mha area is slightly and extremely saline, respectively (Alam and Khan, 2006). The production of agriculture utilizing saline irrigation water has been reduced during the last couple of years. It is proposed to start decreasing when soil pH will surpass 8.5 or when the EC of soil is higher than 4 dS/m (Rajpar *et al.*, 2006; Sairam *et al.*, 2002).

Salinity on the surface of the soil is produced by the capillary action in regions with high water-tables (Aslam, 1998). This phenomenon is quite common in regions having reduction in arid period in lands covered by high waterlogged sand. Numerous approaches can help in adapting to salinity including introduction of bio-saline agriculture and promotion of salt-tolerant species like *sesbania*. This can produce high fodder of biomass at 7.5 ton/ha (van Steenberg *et al.*, 2015).

In Indus plain, water level is rising in saline ground water zones at a higher rate compared to freshwater zones. This has been deteriorating the land and irrigation water quality specifically for the landholders, in the affected areas (Qureshi *et al.*, 2008). Therefore, keeping the facts in view, an attempt has been made to investigate the salt movement, in the salt affected soil, in semi-arid areas. Hence, the current study aimed to assess the impact of varying irrigation schedules of time on the physicochemical properties of saline soil and salt leaching in the soil profile. This work demonstrates the alternative managements by suppressing the salts under the root zone so that efficient agricultural practices can be used.

## Materials and Methods

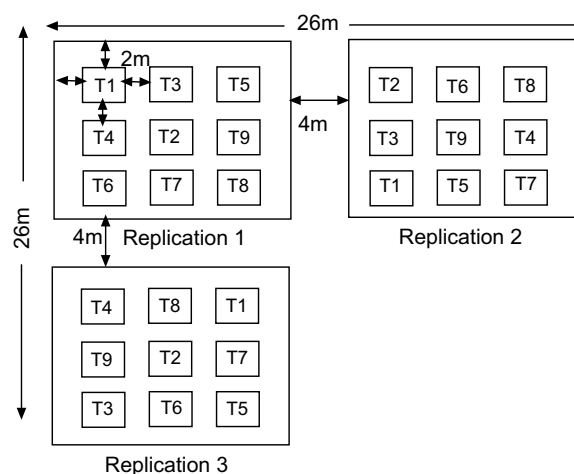
**Experiment site.** The field experiment was carried out at Tando-Allahyar, Sindh, Pakistan during the summer of 2017. The site is located at longitudes of 68°05'16"E to 68°02'03"E and latitudes 25°01'33"N to 25°03'43"N in

a semi-arid zone. Due to a hot climate, the evaporation rate was higher, with the mean maximum temperature ranges from 38 °C to 43 °C, whereas the mean annual rainfall was about 250 mm. This site was 200 km away from the Arabian sea.

The selected site was highly saline, and the water-table depth of the experimental site was 100 m. Hence, this study did not consider groundwater. The soil of the area was clay loam and contained from 50-80 percent of silt. The experimental plot was designed considering two variable aspects (*i.e.*, amount of water and irrigation schedules of times) repeated thrice (*i.e.*, R1, R2 and R3) in a Randomized Complete Block Design (RCBD).

The treatment involved three treatments of irrigation water (*i.e.*, T1 7, T2 14 and T3 21 day irrigation intervals). The size of the experimental field plots was 26 x 26 m and the plots were separated into 3 equal blocks. Individually, every block was further divided into subplots with 1 m x 1 m (1m<sup>2</sup>) each with 2 m between plots and was separated by levees as shown in Fig. 1.

**Soil sampling.** Prior to each application of irrigation water, the samples of soil were taken from every plot at the soil depths of 0-30, 30-60, and 60-90 cm, respectively in separate pots for the determination of soil moisture. The samples were collected in small bags for chemical investigation. Soil specimens from specific depth were mixed well to make a compound specimen. Next, the compound specimens were taken to laboratory and examined (Jackson, 1958). The Bouyoucos hydrometer method, recommended by Richards (1969), was used to analyze the soil-texture.



**Fig. 1.** Layout of the experimental site.

**Electrical conductivity and pH of the soil.** The electrical conductivity (EC) shows salinity, thus, its concentration depicts the salinity level. Irrigation water and soil with  $EC_e > 4.0 \text{ dS/m}$  is treated to be the saline. Whereas, pH shows acidity (sodicity) and pH of 7.0 is considered neutral. EC was calculated by digital EC meter (model HI-8333) and pH was examined by digital pH meter (model SP-34 sunteor) as advised by Richards (1969).

**Cations and anions of soil.** Cation exchange capacity (CEC) is an overall capability of certain soil to keep exchangeable cations. It impacts the soil's capacity to keep necessary nutrients and provides protection from soil acidification. Whereas, in anions, the amount of negative charge depends on soil texture which is related to soil particle surface area. Carbonates plus bicarbonates, calcium and chlorides were investigated by the titration method, whereas sodium was examined by EEL-Flame photometer as advised by Richards (1954).

**Sodium adsorption ratio and exchangeable sodium percentage.** The sodium adsorption ratio (SAR) of the soil indicate the sodicity and its values assess the intensity of sodicity in soil. The SAR shows the relation between sodium ions ( $\text{Na}^+$ ) and calcium plus magnesium ions ( $\text{Ca}^{++} \text{Mg}^{++}$ ). This sodicity of the soil represents as Exchangeable sodium percentage (ESP). The SAR below 7.0 and ESP below 15.0 is considered non-sodic (Davis *et al.*, 2007).

The sodium adsorption ratio (SAR) and exchangeable sodium percentage (ESP) were assessed through the equation presented by Richards (1954).

$$\text{SAR} = \frac{\text{Na}^{++}}{\sqrt{(\text{Ca}^{++} + \text{Mg}^{++})/2}} \dots\dots\dots \text{eq. 1}$$

$$\text{ESP} = \frac{100(-0.0126 + 0.01475 \times \text{SAR})}{1 + (-0.0126 + 0.01476 \times \text{SAR})} \dots\dots\dots \text{eq. 2}$$

**Quality of irrigation water.** The condition of water for application of irrigation has a vital role in leaching salts. Water-table was around 100 m deep and considered to be negligible. In this study, canal irrigation water samples were taken periodically during the experiment. These water samples were investigated for the  $EC_w$ , pH, and SAR parameters (Laboratory, 1954).

**Irrigation scheduling.** Irrigation scheduling is specifying the time and quantity of water to be given

for irrigation. The texture of the soil is an important factor when determining the rate and amount of irrigation applications. In Pakistan, the irrigation system allows water application on a rotation base with 7 days irrigation interval. Therefore, the time schedules were specified in such a way that the irrigation water could be accessible to the growers in accordance with the irrigation time schedules designated for the field experiment. The observation initiated following the site selection and was done after the preparation of plots. Overall, three irrigations were applied at 7, 14 and 21 day schedules of irrigation, respectively. Three pore volumes were designed to apply water for irrigation. The ultimate depth of irrigation water needed for every plot was measured by using the formula given by (Vogeler, 2001).

$$\text{Pore volume} = \text{cross sectional area} \times \text{depth profile-volume of solids} \dots\dots\dots \text{eq. 3}$$

The irrigation application of water rates was 8, 9 and 10 cm depth of irrigation water on  $1 \text{ m}^2$  area of each. The soil samples were collected at the depths of 0-30, 30-60, and 60-90 cm for the soil moisture contents by using core sampler from every experimental plot. These soil specimens were transferred to a laboratory for investigation. The equation given by Reeb *et al.* (1999) was used to ascertain soil's moisture content.

$$\theta_w = \frac{W_w - W_d}{W_d} \times 100 \dots\dots\dots \text{eq. 4}$$

where:

$\theta_w$  is the soil moisture content (%);  $W_w$  is the weight of wet soil specimen (g) and  $W_d$  is the weight of oven dried soil specimen (g).

**Statistical analysis.** Using SPSS Version 25.0, a two-way analysis of variance (ANOVA) was run to assess the significance of irrigation schedules and depth of irrigation water effects on soil EC and pH.

## Results and Discussion

Soil qualities of the experiments are shown in Table 1. The texture for complete profile depth (0-90 cm) was determined as clay to silty clay loam. Capacity of field as well as its wilting point was 24 and 14.2%, respectively. The moisture content before irrigation application was 10.6% as shown in Table 1. The soil's moisture content was less than 15%. The bulk density

**Table 1.** Physical characteristics of the experimental soil

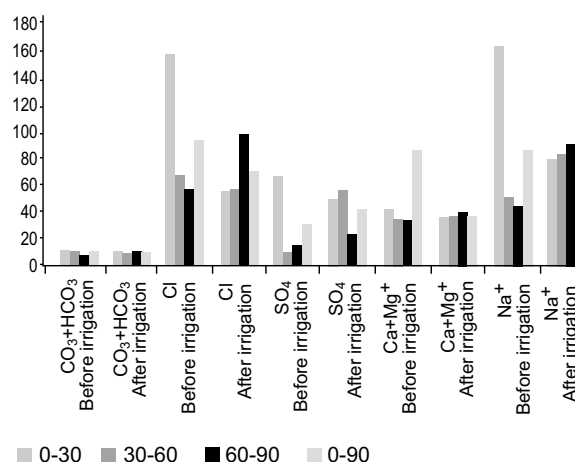
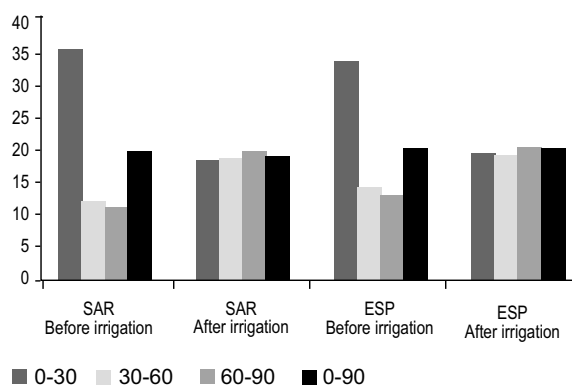
Soil depth (cm)	Moisture content (%)	Field capacity (%)	Wilting point (%)	Bulk density (g/cm)	Textural class
0-30	7.0	22	13.4	1.13	Clay loam
30-60	10.0	24	14.2	1.16	Silty clay loam
60-90	15.0	24	14.1	1.19	Silty clay loam
0-90	10.6	26	15.3	1.16	Silty clay loam

of soil, however, was 1.16 g/cm with mean over 90 cm depth which indicates that the soil was considered clay to silty clay loam.

The quality of irrigation water has a principal role in the salt movement in soil. Table 2 demonstrates the analytical parameter of water specimens and shows that water was non-saline (i.e., E.Ciw<1.5dS/m, pH up to 7.2, and SAR<1.0). Hence, these values showed that the quality of irrigation water was under safe limits to perform salt leaching.

**Anions and cations of soil.** Chemical examination of the samples of soil, which were collected preceding and succeeding irrigation application for 0-30, 30-60, and 60-90 cm, was performed (as shown in Fig. 2). By applying 10 cm depth of irrigation water with 21 days irrigation interval, the mean carbonate plus bicarbonate slightly decreased from 9.0 to 8.8 meq/L, while the mean chlorides cut down from 93.69 to 69.48 meq/L and the mean sulfate increased from 29.52 meq/L to 41.63 meq/L (as shown in Fig. 2). The mean calcium plus magnesium and sodium values for 21 day irrigation time schedule slightly reduced from 85.93 to 36.47 meq/L under the 10 cm depth of irrigation water. However, sodium was a dominant cation which slightly reduced from 85.80 to 83.52 meq/L after 21 days irrigation interval as shown in Fig. 2.

**Sodium adsorption ratio and exchangeable sodium percentage.** The sodium adsorption ratio (SAR) and exchangeable sodium percentage (ESP) of the soil are shown in Fig. 3. The mean (SAR) before irrigation was 19.83 with the application of 10cm depth of irrigation

**Fig. 2.** Chemical analysis of soil samples taken before and after 21 day irrigation at a 10 cm depth of irrigation water.**Fig. 3.** SAR and ESP of soil samples taken before and after 21 day irrigation at a 10 cm depth of irrigation water.**Table 2:** Analysis of irrigation water quality

Sampling date	Source of water	Parameters				Water quality
		ECiw (dS/m)	pH	SAR	RSC	
04-05-17	Canal water	0.50	7.1	1.8	Nil	Fresh
11-05-17	Canal water	0.48	7.2	1.8	Nil	Fresh
30-05-17	Canal water	0.53	7.1	1.9	Nil	Fresh

water after the 21 day interval it was somewhat reduced to 19.1 at a 0-90 cm depth of soil. Whereas an (ESP) value somewhat reduced from 20.40 to 20.04 at a 0-90 cm depth of soil and this reduction can be clarified through reality that the proportion of  $\text{Na}^+$  to  $\text{Ca}^{++}$  in the soil is  $< 1$  in the non-saline irrigation water as mentioned in Fig. 3. The above results indicate that the top layer of soil had more soluble carbonates and bi-carbonates and this is in line with (Campos *et al.*, 2003) who reported that irrigation with saline water caused in instant buildup of salts, specifically in topsoil layer. The adverse effects were mostly related accumulation of salts in soil which might result in less growing rate in crops (Maas and Tanji, 1990). Though, irrigation supply of water having EC less than 1 dS/m reduced level of  $\text{Na}^+$  and  $\text{Cl}^-$  (Belhouchette *et al.*, 1997).

**Electrical conductivity and pH of the soil.** The EC of soil at 3 depths (i.e., 0-30 cm, 30-60 cm and 60-90 cm) was calculated before and after irrigation under 8, 9, and 10 cm depth of irrigation water, respectively. Before irrigation, the minimum and maximum EC was 7.73 dS/m at 60-90 cm and 20.69 at 0-30 cm, respectively. Whereas, before irrigation, a minimum and maximum mean of pH was 7.89 at 0-30 cm depth and 8.04 at 60-90 cm depth, respectively. The total mean was 7.99 at 0-90 cm.

A comprehensive statistical examination was conducted. Initially, we focused on only comparing the EC and pH

data of the three treatments against the data before any treatment. The results of the descriptive statistics of the EC and pH, before and after irrigation treatments, day-wise and depths-wise, are summarized in Table 3. It is clear from Table 3, that the mean EC and the mean pH of the soil are minimal in the case of 7 days interval. The maximum mean decline was observed in the EC and pH overall compared to the mean EC and pH value appearing before.

Finally, the data of EC and pH of soils were analyzed using two-way analysis of variance (2-way ANOVA) suitable for a RCBD with three replications. Following were the hypotheses of this study:

The null hypothesis,  $H_0$  = there is no difference in mean EC and mean pH with respect to days' time schedule and depth of irrigation water. Mathematically it is represented by the following equations.

$$(\mu\text{EC})_{7\text{days}} = (\mu\text{EC})_{21\text{days}} = (\mu\text{EC})_{21\text{days}} \dots\dots\dots \text{eq.3}$$

$$(\mu\text{pH})_{7\text{days}} = (\mu\text{pH})_{21\text{days}} = (\mu\text{pH})_{21\text{days}} \dots\dots\dots \text{eq.5}$$

$$(\mu\text{EC})_{10\text{cm}} = (\mu\text{EC})_{9\text{cm}} = (\mu\text{EC})_{8\text{cm}} \dots\dots\dots \text{eq.6}$$

$$(\mu\text{pH})_{10\text{cm}} = (\mu\text{pH})_{9\text{cm}} = (\mu\text{pH})_{8\text{cm}} \dots\dots\dots \text{eq.7}$$

A significance level of 5% to search for evidence in favor of  $H_0$  has been set. A P-value of more than 0.05

**Table 3:** Descriptive statistics of EC and pH data before and after treatments with respect to days intervals and depths of irrigation water

Variables		Days interval/ Depth (cm)	Mean	95% confidence interval for mean		Median	Range	Standard deviation
				LL	UL			
EC	Before	0	12.25	7.38	17.11	8.35	12.96	6.32
	after	7 days	4.68	4.11	5.25	4.50	2.57	0.73
	day-wise	14 days	9.14	7.48	10.81	8.73	6.48	2.16
		21 days	14.48	12.97	15.99	15.40	5.36	1.96
	After depth-wise	10cm	8.00	5.34	10.65	7.96	9.11	3.45
		9cm	9.43	5.63	13.22	8.30	11.78	4.94
8cm		10.88	7.26	14.50	11.75	11.94	4.71	
pH	Before	0	7.98	7.93	8.04	8.03	0.15	0.07
	after	7 days	7.77	7.73	7.80	7.78	0.14	0.04
	day-wise	14 days	7.97	7.90	8.03	8.00	0.30	0.08
		21 days	7.98	7.94	8.02	8.00	0.13	0.04
	After depth-wise	10cm	7.86	7.77	7.96	7.90	0.40	0.12
		9cm	7.91	7.82	8.00	7.99	0.30	0.11
8cm		7.94	7.86	8.02	8.00	0.26	0.10	

Note: LL = lower limit; UL= upper limit.

**Table 4.** ANOVA output for the difference between mean ECs day-wise and depth-wise

Source	Type III sum of squares	df	Mean square	F	P
Model	2875.54	5	575.10	357.53	0.00
Days	433.03	2	216.51	134.60	0.00
Depth	37.38	2	18.69	11.62	0.00
Error	35.38	22	1.60		
Total	2910.92	27			

Note: df = degrees of freedom.

is considered as evidence in support of  $H_0$ . The alternative hypothesis,  $H_a$  is simply the negation of  $H_0$  and supports a significant difference between mean EC and pH regarding days' time interval and depth of irrigation water at 0.05 level of significance.

The output of 2-way ANOVA test at 5% level of significance for the EC of the soil is given in Table 4. This indicates that there is a significant difference in the model data generally with F equal to 357.535 ( $P < 0.05$ ). This is specifically, due to the day's interval with F equal to 134.604 ( $P < 0.05$ ) and depth of the irrigation water with F equal to 11.62 ( $P < 0.05$ ). Based on the ANOVA results in Table 4, the null hypothesis is rejected. To explore the mean differences which particularly resulted in this rejection, we performed Least significant difference (LSD) which is a post-ANOVA test incase ANOVA leads to rejecting the null hypothesis initially.

The results of LSD for EC data are summarized in Table 5. All the mean differences in EC data day-wise and depth-wise are statistically significant with  $P < 0.05$ . Moreover, it can be seen from Table 5 that the highest

negative difference in mean EC of soil appears between days intervals of 7 and 21, and between the irrigation water depths of 10 and 8 cm. This indicated that the EC after 7 days interval and 10 cm depth of the irrigation water remained lowest among all replications of the irrigation treatment from 7 to 21 days and 10 to 8 cm depths.

Hence, the 7 day interval results in a positive response in EC compared to the 14 and 21 day irrigation schedules. The concentration of salt in upper layer might be associated with an increased evaporation amount from the saturated layer as reported by (Yazar *et al.*, 2003). Moreover, a high saline irrigation, having EC of 6.0 and 8.0 dS/m, significantly boosted soil salinity during brief growth time. The saline irrigation with an EC of 4.0 dS/m can be applied with no reductions in maize production if soil salinity is sustained (Hussain *et al.*, 1981). The same trend was also reported by Li *et al.* (2003) that the saline irrigation for long period could result in possible secondary salinity in the soil. The findings are in harmony with (Ma *et al.*, 2008) who conducted a field experiment in North China Plain. They revealed that the average soil ECe irrigated with

**Table 6.** ANOVA output for the difference between mean pH day-wise and depth-wise

Source	Type III sum of squares	df	Mean square	F	P
Model	1689.61	5	337.92	108231.60	0.00
Depth	0.02	2	0.01	4.53	0.02
Days	0.24	2	0.12	39.81	0.00
Error	0.06	22	0.00		
Total	1689.68	27			

Note: df = degrees of freedom

**Table 5.** LSD exploration for the difference between means ECs day-wise and depth-wise

(I) days interval/ depth of irrigation water	(J) days interval/ depth of irrigation water	Mean difference (I-J)	SE	P	95% Confidence interval	
					LL	UL
7days	14 days	-4.46*	0.59	0.00	-5.70	-3.22
7days	21 days	-9.79*	0.59	0.00	-11.03	-8.55
14days	21 days	-5.33*	0.59	0.00	-6.57	-4.09
10cm	9cm	-1.42*	0.59	0.02	-2.66	-0.18
10cm	8cm	-2.88*	0.59	0.00	-4.12	-1.64
9cm	8cm	-1.45*	0.59	0.024	-2.69	-0.21

\*. The mean difference is significant at the 0.05 level; Note: LL = lower limit; UL= upper limit; SE = Standard error.

**Table 7.** LSD explorations for the difference between mean pH day-wise and depth-wise

(I) days interval/ depth of irrigation water	(J)days interval/ depth of irrigation water	Mean difference (I-J)	SE	P	95% Confidence interval	
					LL	UL
7days	14 days	-0.19*	0.02	0.00	-0.25	-0.14
7days	21 days	-0.20*	0.02	0.00	-0.26	-0.15
14days	21 days	-0.01	0.02	0.67	-0.06	0.04
10cm	9 cm	-0.05**	0.02	0.06	-0.10	0.00
10cm	8 cm	-0.07*	0.02	0.00	-0.13	-0.02
9cm	8 cm	-0.02	0.02	0.34	-0.08	0.029

\*The mean difference is significant at the 0.05 level; \*\*The mean difference is significant at the 0.1 level;  
Note: LL = lower limit; UL= upper limit; SE = Standard error.

saline water was more than the E<sub>Ce</sub> of soil irrigated with fresh water.

Table 6. summarizes the output of 2-way ANOVA test at 5% level of significance for the pH of the soil. The model indicates that there is a significant difference in the model data generally with F equal to 108231.605 ( $P < 0.05$ ). This is specifically due to the day's interval with F equal 4.53 ( $P < 0.05$ ) and depth of the irrigation water with F equal to 39.815 ( $P < 0.05$ ). Based on the ANOVA results in Table 6, the null hypothesis is rejected. For a further and detailed exploration of the differences, the results of LSD for pH data are given in Table 7.

Most of the mean differences in pH data day-wise and depth-wise are statistically significant with  $P < 0.05$ . It can be seen from Table 7 that the maximum negative difference in mean pH of soil appears between days intervals of 7 and 21, and between the irrigation water depths of 10 cm and 8 cm, again indicating that the pH after 7 days interval and 10 cm depth of the irrigation water remained the lowest among all replications of the irrigation treatment from 7 to 21 days and 10 to 8 cm depths. At 1% level of significance, the difference between the mean pH at 10 cm and 9 cm depths were significantly different. On the other hand, there was not a significant difference at 0.05 level of significance between the mean pH data of 14 and 21 days ( $P = 0.677$ ) and depths 9 cm and 8 cm ( $P = 0.342$ ).

Overall, the 7 day irrigation interval took pH closer to the normal. The findings are consistent with past study (Feizi *et al.*, 2007) as authors also reported the need to recognize the volume of fruitful rainfall with irrigation depth, efficient irrigation management practices for achieving productive leaching, and avoid the salts buildup in the root zone. However, the fall in the amount

of irrigation water for leaching substantially increases salinity of soil as well as drainage effluent, eventually resulting in yield reduction (Hassanli *et al.*, 2010). Dahiya *et al.* (1981) reported that leaching efficiency can be improved through intermittent leaching. Furthermore, a gradual water movement is related with considerable salt leaching efficiency along with improved percolation time (Shaygan *et al.*, 2017).

## Conclusion

Overall, the saline soils of Sindh, Pakistan contained a high quantity of salts like sodium chloride and calcium sulfate due to capillary rise mainly owing to lack of rainfall and a high rate of evapotranspiration (ET). Based on the irrigation interval day and depth of irrigation water, three replications for EC and pH were measured. The two-way ANOVA and successive LSD indicated that there was statistically a significant difference in EC ( $P = 0.05$ ) and in pH ( $P = 0.05$ ) in association with irrigation interval day and depth of irrigation water. It was observed that the 7 days interval with irrigation depth of 10 cm resulted in a maximum decline in the EC and pH. Results showed that the 7-days irrigation interval was more effective for leaching the salts compared with 14 and 21 day intervals. Therefore, cotton, sugarcane, fodder crops, and wheat could be cultivated. The growers and researchers are advised to favor 7 days interval of irrigation for soil reclamation by using irrigation water having less than 1 dS/m with furrow mode. Thus, before crop sowing, the leaching can be done to control the salts to provide a suitable environment to root-zone.

**Conflict of Interest.** The authors declare no conflict of interest.

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