

## Impact of Low-Quality Ground Water on Agriculture

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### -----ABSTRACT-----

The renewable freshwater resources of Earth are limited and due to increase in population rate the said source is diminishing quickly. Therefore, alternative strategies are performed by the users to meet the requirement. Among the most preferred strategies tube well water is listed on prior basis. Due to excess usage or low-quality tube well water, crop yields are badly affected as it has been reviewed in previous literature. Because of the importance of tube well water, the recent study performed titled as "Impact of low-quality ground water on Agriculture". As the from the reports, the sanctioned water requirement per thousand acres of the area under study ranged from 2.96 to 4.76 cusec. Water shortage is a real issue of the area and nearby therefore a large number of tube wells are introduced in the area to supplement the need and approximately, each farm contains 1-2 number of tube wells to enhance the soil health and water quality, soil management practices are limitedly applied in the area under study. Therefore, the crop yields of the surveyed area are severely affected due to the above reasons and reductions observed with the utilization of tube well water was 3.5 to 36%. Different water quality parameters were analyzed and resulted as electrical conductivity measured in dS/m ranged from 2.0 to 3.9. pH of water ranged from 7.3 to 8.6. Total soluble salts observed in ppm ranged from 1405 to 2730. Chloride (Cl<sup>-</sup>) ranged from 8.8 to 18.8, Carbonate and Bicarbonate ranged from 0.5 to 1.3 and 5.4 to 7.5, respectively. Sodium, calcium and magnesium content analyzed in m/mol ranged from 8 to 26, 3.6 to 8.1 and 1.8 to 7.7, respectively. Nitrate and phosphorous content ranged from 7.1 to 14.5 and 0.5 to 1.9 mg/l, respectively. Potassium content ranged from 0.1 to 0.3 m/mol. For irrigation purposes water quality parameters analyzed, and majority of the samples taken were hazardous in nature. Texture of soil was analyzed, and maximum samples of the soil were heavy in texture, having alkalinity in medium range. Reduction in the crop yields and soil properties has considerably been indicated by the experiments performed on the tube well water. For better results in achieving maximum yields different strategies has been performed like using canal water instead of tube well water and mixing canal water with tube well water. It is further depicted in the results, for improving soil health and enhancing water quality different soil management practices may be incorporated and water used for irrigation could be used conjunctively.

**KEYWORDS:** Ground water, Crop yields, Chemical properties of soil and water, Nutrient content, Conjunctive utilization.

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Date of Submission: Date, 12. October 2019  Date of Publication: 15. November 2019  
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### I. INTRODUCTION

Throughout the world freshwater assets are being squeezed due to shift in atmospheric patterns, and food security is having a major threat of an extreme water deficiency. Most of the developed countries are overpopulated. Shrewd appropriation of freshwater among various partners is an essential, domestic use is given priority. Wastewater or water having salinity could be used for agriculture purpose with proper treatment and good management practices [1]. Agriculture sector contributes a big share (20.9 percent) in Gross Domestic Product (GDP) in Pakistan. A large area is used for wheat cultivation in Pakistan and wheat crop is also termed as main crop to meet the agriculture needs of the country. The area used for the cultivation of wheat crop in Pakistan in 2018 was 9.180 hectares and producing 26.3 million tons. In addition to that shortage of irrigation water and dependency on tube well water is also an important cause that leads to soil degradation and loss of yield of wheat. In addition to that shortage of irrigation water and dependency on tube well water is also an important cause that leads to soil degradation and loss of yield of wheat [2]. In the Indus basin, for the agriculture sector in Pakistan ground water is contributed around 35% of the total available water resources. Out of which, 60% of extracted water is lying between marginal to saline range and remaining percentage is serviceable that's being polluted and saddled through a large number of tube wells [3]. late 50's in Pakistan approximately 60 years ago and various projects were started all over country under the supervision of salinity control and reclamation project (SCARP). Total 16679 tube wells were introduced in 61 finished SCARPs, including 12746 fresh and 3933 saline tube wells [4].

Since then, countless tube wells have additionally been introduced in public and private area and its quantity continuously proceeds at a normal yearly increasing rate of around 9.6% [5]. Through, the conjunctive utilization of saline water with canal water does not prepare for salinity development but rather still it is a decent water management choice important for a few reasons. For instance, during chlorine water deficiencies, it is used to supplement the water needs of the crops; with no disposal systems, the conjunctive utilization of tube well water with canal water is the main alternative to bring down the water tables; except if an appropriate outlet is accessible, it is practical way to dispose-off saline tube well water; finally, canal supplies at the tail end of the systems are low and the ground water quality poorer than upstream areas, such a situation forces the farmers to practice saline and canal water conjunctively. The investigation led has focused around the zones where the tube well is being utilized for irrigation. The impact of tube well installed in fresh water zone and marginal zone will be analyzed. The study has been carried out in District Jacobabad of Sindh Province. The district is spread more than 2,686 Km<sup>2</sup> out of which around 25,567 ha are under cultivation. Agriculture is the main source of area with rice, wheat and grams are grown extensively in the area. The crops are inundated through main Beghari Canal originating from Guddu Barrage. Being tail ender, shortage of canal irrigation water always remains one of the major problems of the farmers in the area; thus, utilize tube well water as an alternative source to cultivate their productive and fertile lands. Since, irrigation with great quality water don't represent any genuine risk yet the utilization of low quality without appropriate management may result in soil degradation in the area, subsequently there is a need to conduct a study to determine the water utilization and its effects on for soil salinity, crop production and socio-economic conditions of the growers.

## **II. LITERATURE REVIEW**

In Pakistan, around 83.37 MAF water is accessible at the ranch door to flood a canal area of 14.64 mha. This water asset is inadequate to manage the cultivable land assets. To supplement the surface water supplies, more than of 0.6 million Tube wells pump more than 50 MAF of ground water. As a rule, the pumped water is unsafe up to a degree of 70 - 80%, which is further decaying a direct result huge draw-down. It is evaluated that 70% of the ground waters are marginal or salty. Uncontrolled establishment of tube wells and uncontrolled extraction isn't just exhausting the ground water assets, yet additionally is bringing about serious optional salinization. Along these lines, immediate and ceaseless of low-quality water needs to keep away from and management methodologies close to the source are basic to diminish the dangers of soil salinity [6]. Study follows the canal network of Sukkur Barrage in 1930's, the water table levels in the Left Bank Outfall Drain (LBOD) has been extended from 12 ft to decline 5 ft over 74% of the cultivated areas and below the ground level in many areas [7].

About 70 percent of the 560 thousand tube wells are pumping harsh water. The consumption of saline water has readily affected the soil's health and crop yield decreased [8]. Groundwater is getting depleted fast with tough consequences in most of the basins. The groundwater has already declined below 20 meters in maximum areas which is making water extraction a massive costly operation. Recently, the groundwater table receded by more than 30 meters in Quetta valley. The extreme concerns are raised because the rate of decline is observed over 2 to 3 meters per annum [9]. The ground water quality in over 60% of region packed in the canal charge has salt fixation under 1000 ppm (EC 1.43 dS/m) at a depth of 100 to 400 ft; while, the salt changes from 1000 to 2000 ppm (EC 1.43 to 2.86 dS/m) on around 15% of territory, though, 5% of this has salt going somewhere in the range of 2000 and 3000 ppm (EC 2.86 to 4.28 dS/m), The remaining 20% zone has salt water EC surpassing 4.28 dS/m i.e. over 3000ppm and Revealed that low quality waste effluent having TDS somewhere in the range of 1920 and 2560 ppm could be securely utilized for edit development with expansion of 20% filtering part of canal water [10]. Low quality ground water ideally be utilized as a part of conjunction with canal water. The low-quality ground water ought to be amended with Gypsum for economical farming [11]. Crops could be grown with marginal quality water if utilized effectively with enhanced management skills (selection of crop, water system application strategy and soil management for irrigation) [12]. As high convergence of solvent salts harmed the roots of the cotton plants which in turn hampered supplement take-up by the plant with corresponding reduction in cotton yield. Also analyzed that due to utilization of saline irrigation water there is decrease in cotton yield [13]. "Physiological drought" conditions can be resulted with the high concentrations of salt. Plenty of moisture could be seen with in the field but due to high concentration of salts the roots become unable to extract the water and plants start wilting [14]. Low quality water is certainly not a worthless asset and has incredible potential for yield production. Research shows that such waters can be effectively utilized to better improve cultivating and comprehensive management practices [15]. In the groundwater, with CO<sub>3</sub> and HCO<sub>3</sub> ions the alkalinity is imparted. More concentration of HCO<sub>3</sub> get consolidate with Ca and Mg and will pre-capitate as carbonates when the soil arrangement concentrates in drying condition.

The use of water with high EC massively influences the crop yields. Also added that due the saline water irrigation there is obvious decrease of about 53% in yield of wheat crop [16].

### III. EXPERIMENTAL INVESTIGATION

**Site Selection:** For acquiring the most dependable and reproducible outcomes, randomly selected UCs of Taluka Jacobabad and Taluka Thul were included in the study and through a detailed asked questionnaire and after comparing the asked questionnaire highly impacted site was selected, 5 tube wells have been selected to determine the impacts of water on crop yield and to set an strategy to bear less productive loss in terms if low quality water is used. However, tube wells have been selected in the same farm to thoroughly investigate the impacts of low-quality water on the crop yield and water-soil-crop continuum. Sampling sites are located in Figure.1.

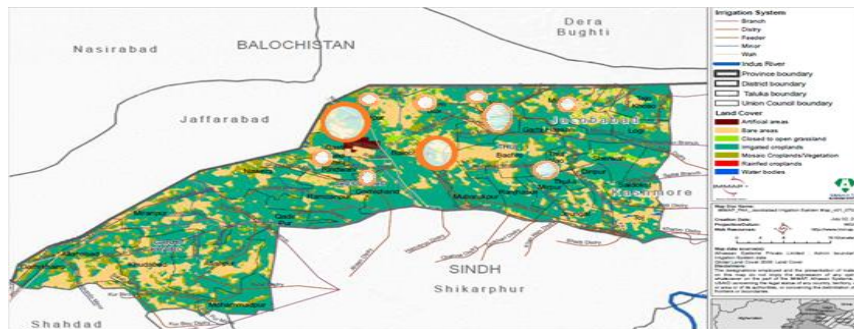


Figure 1: Site Location

**Water Analyzing Methods:** Samples taken were tested to determine alkalinity (pH), electrical conductivity (EC), sodium (Na), calcium (Ca), magnesium (mg), chloride (Cl), carbonate ( $\text{CO}_3$ ), bicarbonate ( $\text{HCO}_3$ ), nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ), phosphorous ( $\text{PO}_4\text{-P}$ ) and potassium (K). Standard procedures have been followed for each situation. With the help of strategies endorsed by Jackson (1958), electric conductivity (EC) and pH of water was determined by utilizing a conductivity and pH meter respectively. By titration with EDTA as briefed by Bray (1945), calcium and magnesium were analyzed. Flame photometry was used to assess sodium and potassium as suggested by Stanford and English (1949) and Toth et al. (1949), respectively. Molyb dophoric blue color as briefed by Murphy and Rilley (1962) is used to analyze the phosphates.

**Sampling of Soil:** From the district Jacobabad 10 sites were selected randomly, 5 from taluka Thul and 5 sites were selected from taluka Jacobabad. Selective area getting irrigation water through different minors/distributary having various discharge. Composite samples were taken up to 60 cm at four depths each depth is of 15 cm i.e. 0-15cm, 15-30cm, 30-45cm and 45-60cm. The samples were taken to determine the physio-chemical properties and nutrient content in soil irrigated with related tube well water.

**Analyzing Soil Samples:** Soil samples taken were analyzed following standard procedures like Hydrometer technique is used to investigate electric conductivity (EC) of soil, pH of soil is determined by using pH meters. Walkley-Black strategy is used to assess the organic matter present in soil. By acid neutralization method lime content is measured. Kedah method is used to determine the nitrogen content present in soil.

**Impact of Tube Well Water on Crop Yield:** The field experiment was conducted in area of different locations of two Talukas of District Jacobabad (Taluka Jacobabad and Thul). According to the least productive area a site was selected, and five tube wells were located at the same farm. Farm of Village Sohno Khan Rind of UC Ahmedpur taluka Jacobabad was chosen for the study which was massively affected in terms of productivity. Three different strategies (Canal water only, Canal + Tube well water and Tube well water only) were made to determine the impacts of low-quality ground water on crop yield, crop selected for study was wheat. According to recent scientific recommendations, all the strategies and cultural practices were applied. For determination of various properties of soil and water of the area the samples at four different depths were taken and at the end the grain yield was recorded from each selected tube well located site.

### IV. RESULTS AND DISCUSSION

This study has been carried out to investigate the quality of water of Taluka Thul and Taluka Jacobabad and its subsequent impacts on soil properties and crop yield. In the following paragraphs of this chapter the results obtained are detailed.

**Soil management practices and Crop yields of the study area:** Selected areas for this study were taken on random basis from Taluka Jacobabad and Thul of District Jacobabad, the controlled area by the cultivators went from 16 to 244 acres. The estimated sanctioned water needed for the selected area for study ranged from 2.96 to 4.76 cusec per 1000 acres. Severe shortage of irrigation water has been observed in the study area. Therefore, to overcome the scarcity maximum number of tube wells are installed in the region and at different depths ranging between 60 to 130 ft, approximately every farm contains one or multiple number of tube wells. About 70% of the tube wells are 3 to 5 years of age. Among them 60% of the growers don't use mixed water for irrigation (tube well water mixed with canal water).

Gypsum is used by only 10% of the progressive growers as a soil amendment to check the risks posed by the utilization of saline tube well water. Farmacyard manure (FYM) is also used in the selected area by only 2% of the growers. For the observed data, for the yield nutrition program only 2% of the growers consider green manuring. With the utilization of tube well water, the yield of wheat crop was found decreasing as compared to the areas where the canal water was utilized for irrigation needs at a same farm. The decrease in yield of wheat crop was found to be 3.5 to 36%.

**Quality and Nutrient content of tube well water:** Table.1(a) and Table 1(b) contains the data regarding quality and nutrient content of tube well water of the selected Talukas (Taluka Thul and Taluka Jacobabad) of District Jacobabad.

**Table 1(a):** Chemical properties and nutrient content of the water samples collected from selected tube wells of District Jacobabad

S. No.	Site No.	pH	EC	TSS	NO <sub>3</sub> -N	PO <sub>4</sub> -P	K <sup>+</sup>
			(dS/m)	(ppm)	(mg/L)	(mg/L)	(m mol/L)
1	T <sub>1</sub>	8.3	3.3	2290	8.2	1.5	0.3
2	T <sub>2</sub>	8.5	3.9	2730	15	1.6	0.3
3	T <sub>3</sub>	8.1	2.8	1910	14.5	1.9	0.2
4	T <sub>4</sub>	8.6	2.4	1680	8.5	1.6	0.2
5	T <sub>5</sub>	7.7	3.1	2190	14.3	1.7	0.1
6	T <sub>6</sub>	8.2	2.5	1780	11.5	1.6	0.2
7	T <sub>7</sub>	7.4	2.3	1610	7.1	0.7	0.2
8	T <sub>8</sub>	7.3	2.0	1405	8.6	0.5	0.1
9	T <sub>9</sub>	7.8	3.6	2510	9.7	1.5	0.3
10	T <sub>10</sub>	8.6	3.7	2580	11	1.8	0.3
	<b>Mean</b>	<b>7.95</b>	<b>2.95</b>	<b>2067.5</b>	<b>10.8</b>	<b>1.2</b>	<b>0.2</b>

**Table 1(b):** Chemical properties and nutrient content of the water samples collected from selected tube wells of District Jacobabad

S. No.	Site No.	Na <sup>+</sup>	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Cl	CO <sub>3</sub> <sup>-2</sup>	HCO <sub>3</sub> <sup>-</sup>
		(m mol/L)					
1	T <sub>1</sub>	12	9.4	7.7	15	1.2	6.2
2	T <sub>2</sub>	26	5.7	2.2	12.2	1.3	6.5
3	T <sub>3</sub>	8	9.8	2.1	9.6	1.2	5.4
4	T <sub>4</sub>	14	9.7	2.9	11.6	0.8	6.5
5	T <sub>5</sub>	24	3.6	1.8	11	1.3	7.5
6	T <sub>6</sub>	16	9.7	2.3	8.8	0.9	6.1
7	T <sub>7</sub>	15	7.1	2.1	9.4	0.7	6.9
8	T <sub>8</sub>	9	11.2	3.7	8.9	0.5	6.6
9	T <sub>9</sub>	17	7.6	3.6	17.7	0.9	5.9
10	T <sub>10</sub>	12	7.7	3.6	18.8	0.9	5.9
	<b>Mean</b>	<b>17.0</b>	<b>7.4</b>	<b>4.75</b>	<b>13.8</b>	<b>0.9</b>	<b>6.45</b>

From the collected data as shown in Table 4.1, it has been observed that prevalence of water samples for irrigation needs on the basis of different nutrient contents and chemical properties were, pH: 20%, EC: 50%, TSS: 40%,

CO<sub>3</sub>: 50%, HCO<sub>3</sub>: 0%, Cl<sup>-</sup>: 0%, Na<sup>+</sup>: 0%, K: 0%, Ca: 0%, Mg<sup>2+</sup>: 10%, PO<sub>4</sub>-P: 0%, NO<sub>3</sub><sup>-</sup>: 50% summarized in Table 1 and shown in Figures 2-5.

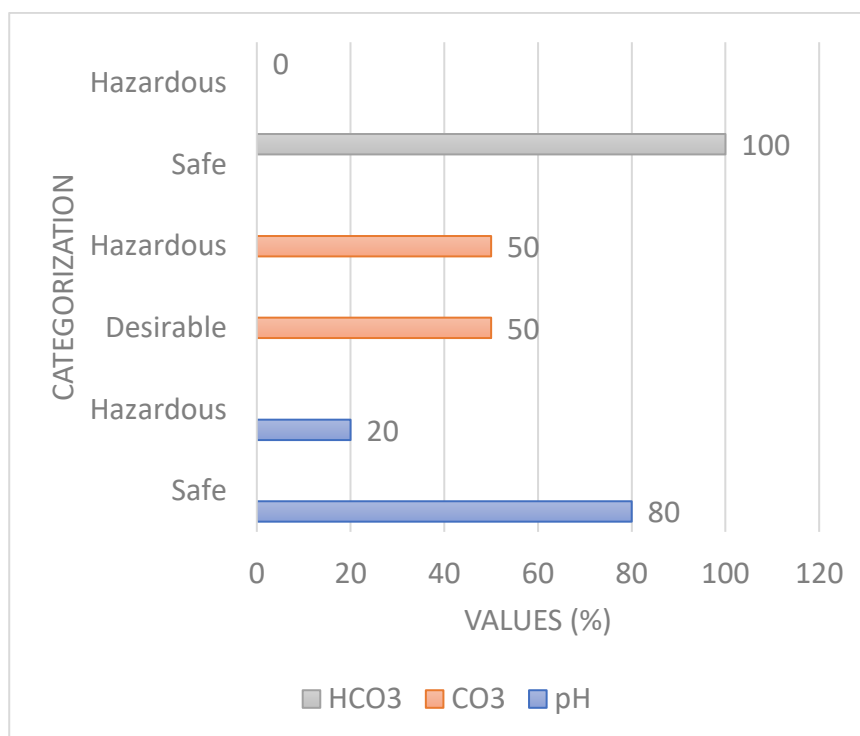


Figure 2: Tube well water samples of study area on the basis of pH, CO<sub>3</sub> and HCO<sub>3</sub>



Figure 3: Tube well water samples of study area on the basis of EC and TSS

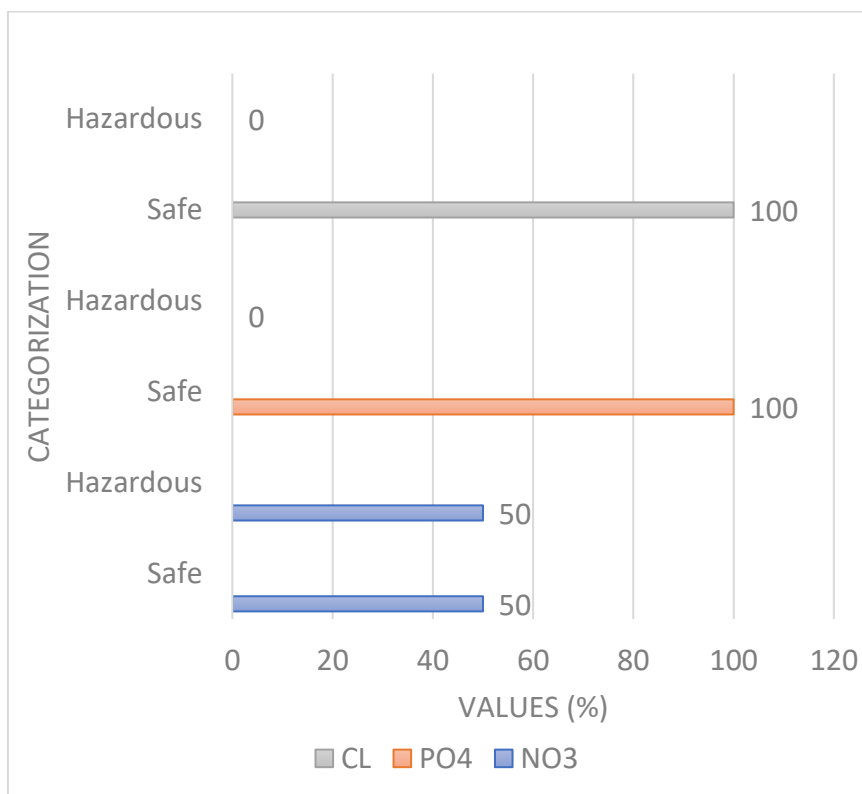


Figure 4: Tube well water samples of study area on the basis of NO<sub>3</sub>, PO<sub>4</sub> and Cl<sup>-</sup>

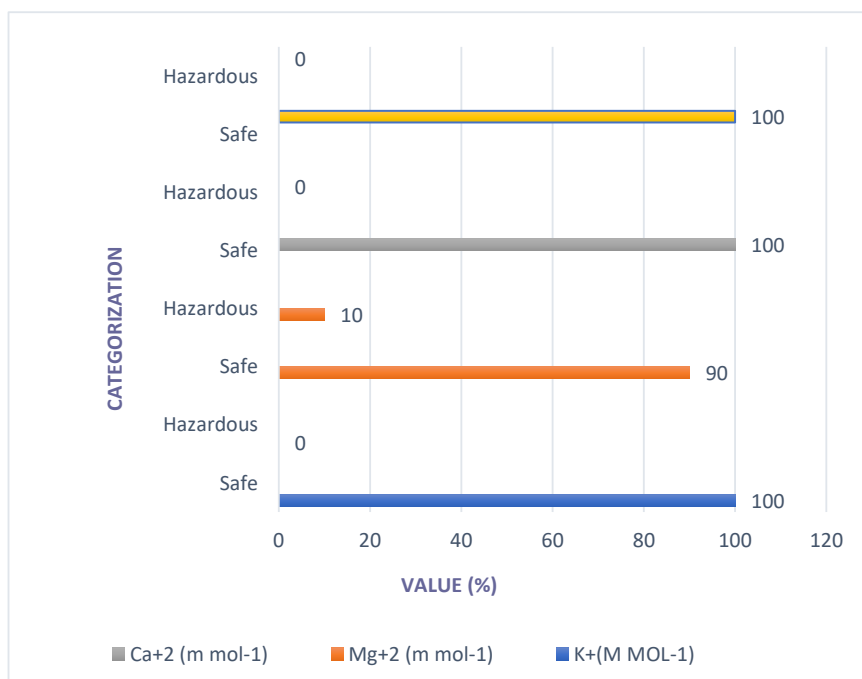


Figure 5: Tube well water samples of study area on the basis of K<sup>+</sup>, Mg<sup>+2</sup>, Ca<sup>+2</sup> and Na<sup>+</sup>

**Soil and nutrient irrigated with relative irrelated tube wells:** Maximum percentage (80%) of the soils found in the category of heavy texture. Clay loam soil texture was mostly observed at a depth of 0-15 cm and for the other depths the similar trend was observed. On the very first depth (0-15 cm), pH value ranged from 7.9 to 8.9 and with the increasing depths from 0-15 to 45-60 cm the values of pH decreased gradually. At a depth of 0-15 cm the value of EC ranged between 7.1 to 10.2 dS/m at the depth of 0-15cm.however, at other soil depths the

average EC decreased with the increasing depth .Organic matter in soil was found to be 0.42 to 0.86 percent at a depth of 0-15 cm, the value of organic matter increased with the increasing depth and then became stable. Lime content present in soil at a depth of 0-15 cm ranged from 9.8 to 15.2 present and the percentage gradually decreased with the increasing of soil depth summarized in Table 2(a) and Table 2(b).

**Table 2(a):** Properties of soils of selected site of District Jacobabad under study area

Site No	Texture				pH				EC dS m <sup>-1</sup>			
	Depth				Depth				Depth			
	1	2	3	4	1	2	3	4	1	2	3	4
1	CL	CL	C	CL	8.9	8.5	8.2	8.1	7.6	6.4	4	3.1
2	CL	CL	C	CL	8.4	8.1	8.0	7.9	8.4	7.6	5.4	5.2
3	CL	CL	C	CL	8.1	7.7	7.7	7.1	7.1	6.1	3.6	3.2
4	CL	CL	C	CL	8.4	8.2	8.0	8.0	7.6	3.2	3	3.2
5	CL	CL	C	CL	8.2	8.0	7.0	7.4	9.2	7.9	3	2.9
6	CL	CL	C	CL	7.9	7.8	7.8	7.5	8.6	7.6	4.1	4.0
7	CL	CL	C	CL	8.4	8.2	8.2	8.0	7.9	7.3	3.2	3.2
8	SC	SCL	CL	CL	8.3	8.2	8.0	7.9	7.9	3.5	3.2	3
9	CL	CL	C	CL	8.4	8.1	7.9	7.8	10.2	8.1	4.1	3.9
10	SC	CL	CL	SCL	8.6	8.4	8.3	8.0	9.3	7.8	3.6	3.2
<b>Mean</b>					<b>8.4</b>	<b>8.1</b>	<b>7.65</b>	<b>8.65</b>	<b>8.65</b>	<b>5.65</b>	<b>4.2</b>	<b>4.1</b>

**Table 2(b):** Properties of soils of selected site of District Jacobabad under study area

Site No	Texture				Organic matter (%)				Lime content %			
	Depth				Depth				Depth			
	1	2	3	4	1	2	3	4	1	2	3	4
1	CL	CL	C	CL	0.48	0.40	0.30	0.21	12.5	11.9	10.8	10.9
2	CL	CL	C	CL	0.44	0.35	0.25	0.11	15.2	14.0	13.4	12.1
3	CL	CL	C	CL	0.59	0.50	0.42	0.30	12.3	11.5	10.5	9.4
4	CL	CL	C	CL	0.42	0.35	0.25	0.18	10.6	10.1	9.2	6.2
5	CL	CL	C	CL	0.62	0.50	0.42	0.31	12.0	12.2	10.1	8.9
6	CL	CL	C	CL	0.68	0.60	0.46	0.40	9.8	8.7	8.3	7.8
7	CL	CL	C	CL	0.52	0.40	0.33	0.25	10.1	9.6	8.1	7.4
8	SC	SCL	CL	CL	0.80	0.66	0.54	0.49	10.2	8.6	8.6	7.6
9	CL	CL	C	CL	0.72	0.62	0.50	0.45	12.6	11.4	9.9	8.8
10	SC	CL	CL	SCL	0.86	0.66	0.52	0.48	14.3	11.5	10.6	8.8
<b>Mean</b>					<b>0.64</b>	<b>0.505</b>	<b>0.395</b>	<b>0.3</b>	<b>12.5</b>	<b>11.3</b>	<b>10.75</b>	<b>9.15</b>

From study region the properties of soil showed that heavy texture is possessed by 80% of the soils, about 80% of soil sample were found to be medium alkaline and remaining were countered in strongly alkalinity range in terms of pH of soil. Electrical conductivity values depict 100% samples on the first depth are very strongly saline as the depth increases the severity index of salinity decreases, all the samples taken (100%) were poor in organic matter. In the soil of study area on the basis of lime content, calcareous index of the samples ranging between 90-100% were found to be moderate in nature summarized in the Table 2(a),2(b) and shown in Figure 6-9.

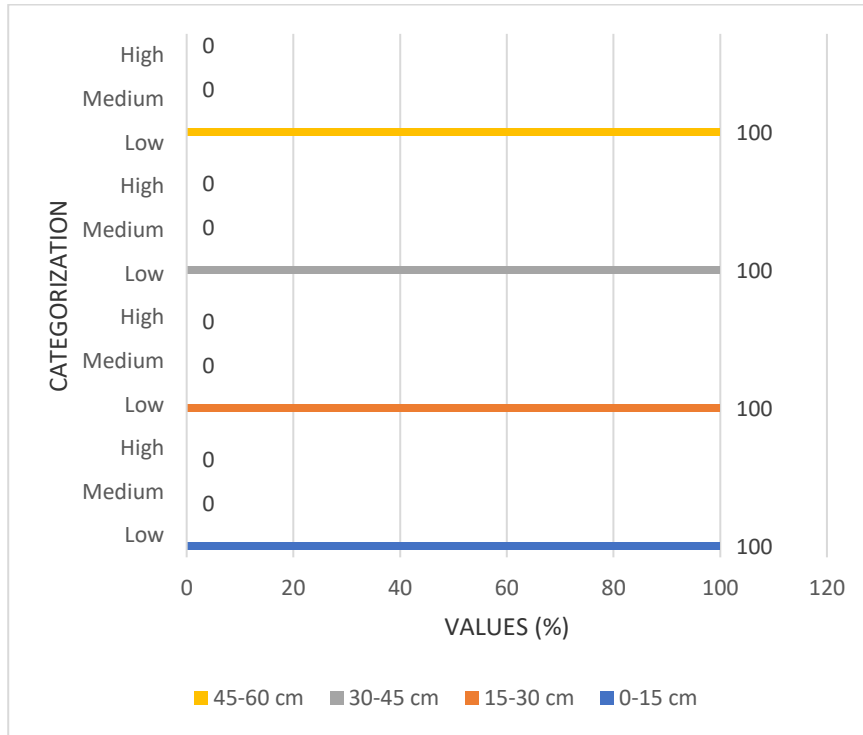


Figure 6: Organic matter of soil irrigated with tube water of the study area

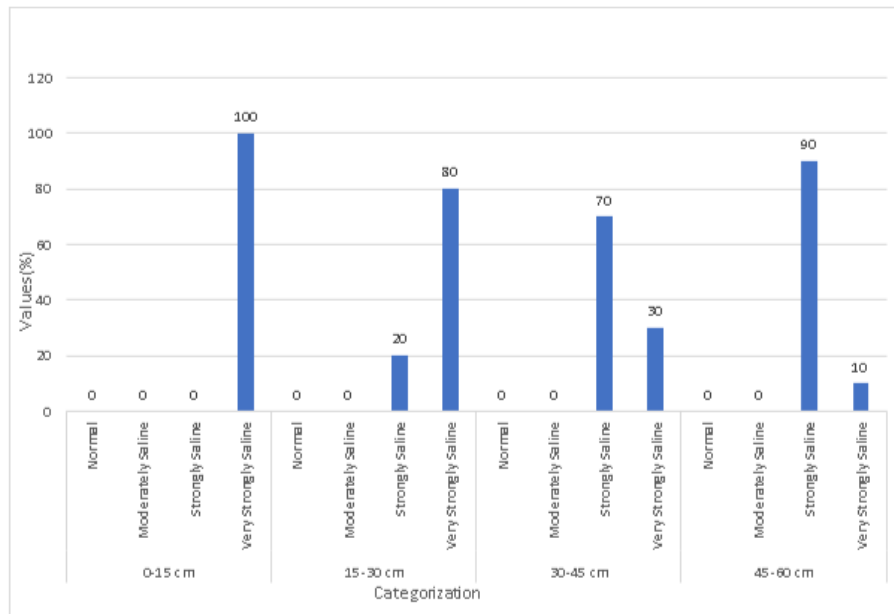
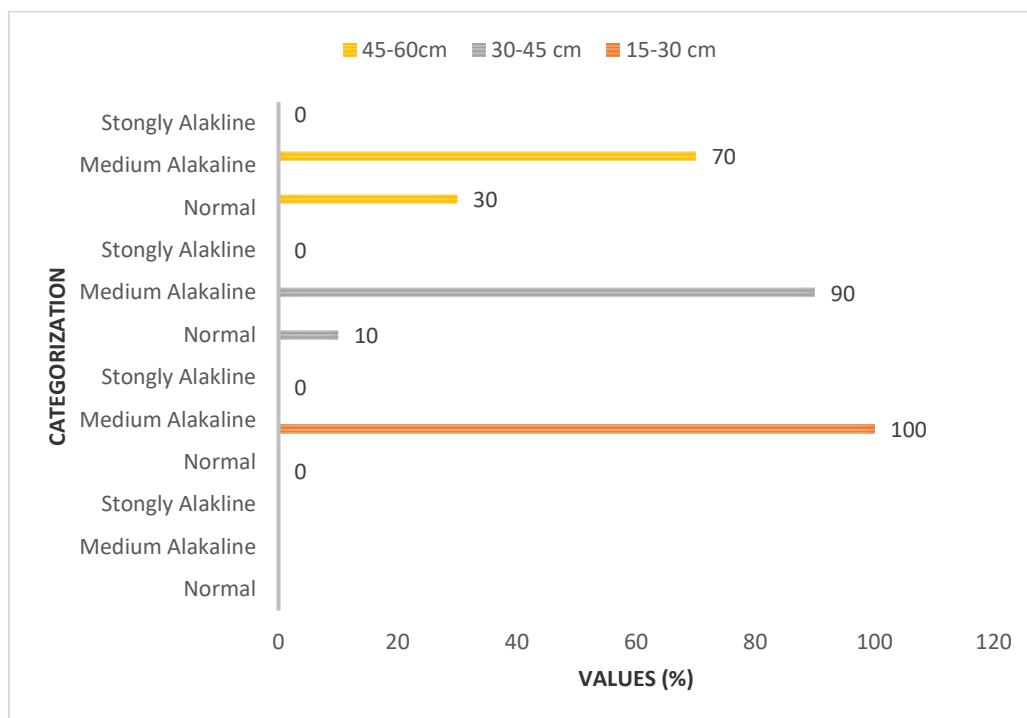
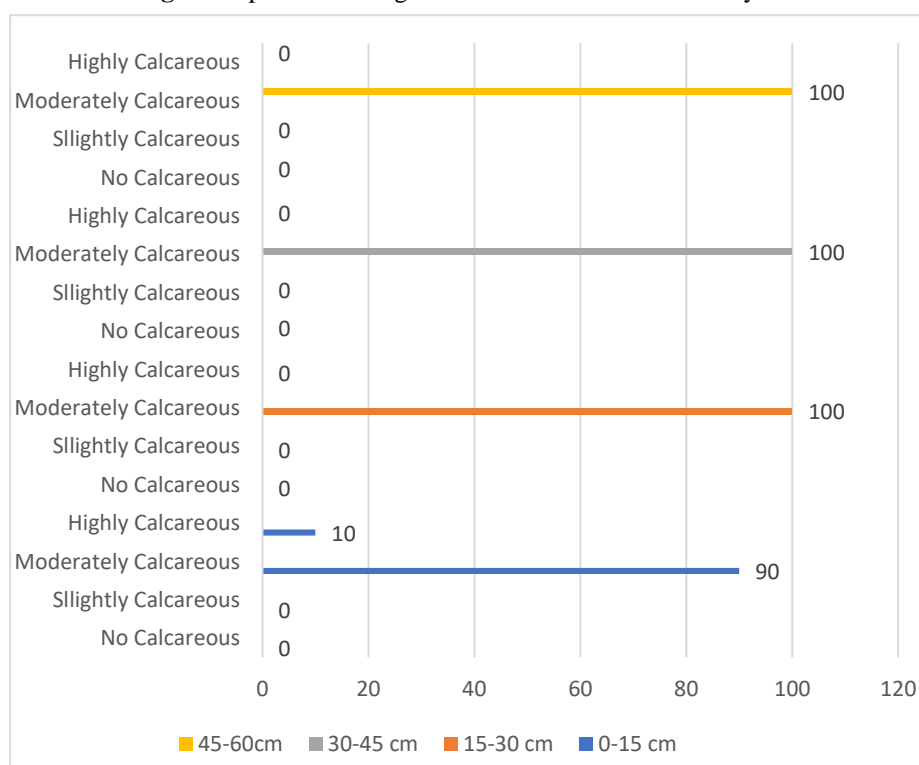


Figure 7: Electrical Conductivity (dSm<sup>-1</sup>) of soil irrigated with tube water of the study area



**Figure 8:** pH of soil irrigated with tube water of the study area

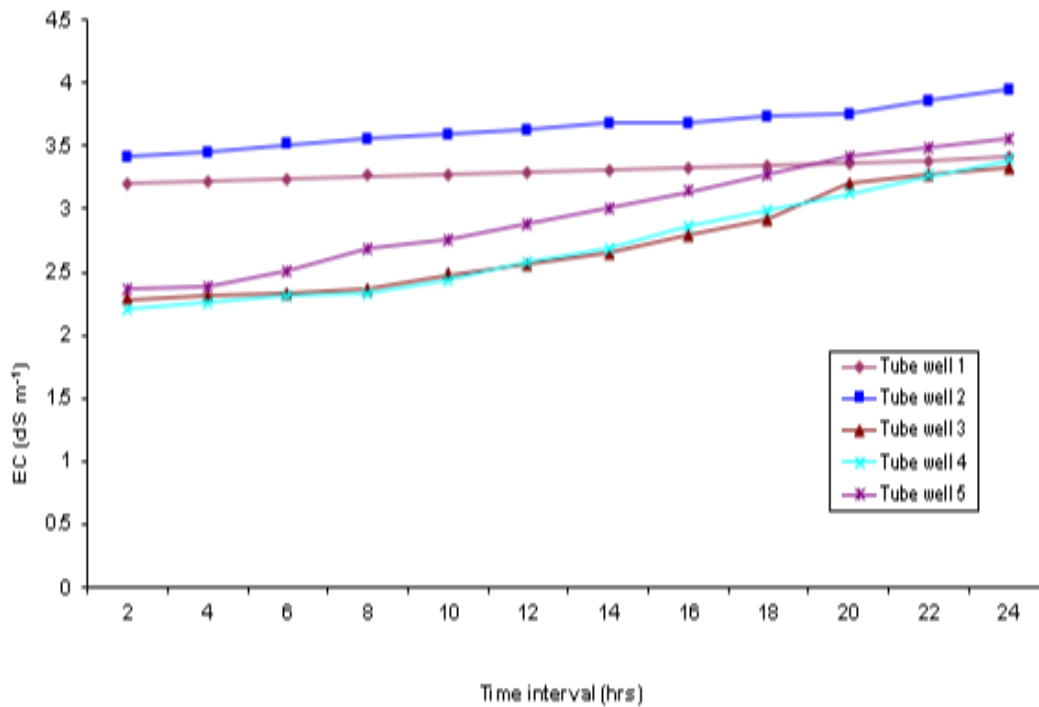


**Figure 9:** lime content % of soil irrigated with tube water of the study area

Evaluating change in EC (ds/m) of selected tube wells after two hours interval for 24 hours operation: The data gathered regarding variation in Electrical Conductivity (dS/m) value of chosen tube wells with interim of two-hours for twenty-four hours are shown in Table 3. A slight change in EC has been observed from the data with the operation of 2-hours interval up to 24-hours. With time because of the high EC (dS/m), two of the tube wells were found hazardous and the rest of the tube wells were in marginal range as shown in Figures 10.

**Table 3:** Change in EC (dSm<sup>-1</sup>) after 2 hours interval for 24 hours of Selected Five Tube Wells

Site No.	Time Interval (Hours)												Average
	2	4	6	8	10	12	14	16	18	20	22	24	
1	3.20	3.22	3.24	3.26	3.28	3.29	3.31	3.33	3.35	3.36	3.38	3.41	<b>3.30</b>
2	3.42	3.45	3.51	3.56	3.59	3.63	3.68	3.69	3.73	3.76	3.88	3.96	<b>3.66</b>
3	2.28	2.31	2.33	2.36	2.48	2.56	2.66	2.79	2.92	3.20	3.28	3.33	<b>2.70</b>
4	2.1	2.26	2.31	2.33	2.43	2.58	2.69	2.86	2.99	3.120	3.26	3.39	<b>2.70</b>
5	2.36	2.39	2.51	2.68	2.76	2.88	3.0	3.14	3.28	3.41	3.48	3.56	<b>2.95</b>



**Figure 10:** Change in EC (dSm<sup>-1</sup>) after 2 hours interval for 24 hours of Selected Five Tube Wells

**Comparison of wheat grain yield (kg/ac) as affected by tube well water:** Water has been applied to the crops by means of different strategies i.e Canal water, mixed Canal with tube well water and Tube water only the data collected regarding comparison of wheat crop with different strategies as shown in Table 4 and Figures 11.

**Table :4** Comparison of wheat grain yield (kg/ac) under different irrigations strategies

Treatments	No. of tube wells					Mean
	1	2	3	4	5	
Canal Water Alone	1440	1320	1220	1265	1160	<b>1281</b>
Canal+ Tube Well Water	1050	930	1040	1090	910	<b>1004</b>
Tube Well Water Alone	640	570	690	720	704	<b>664.8</b>

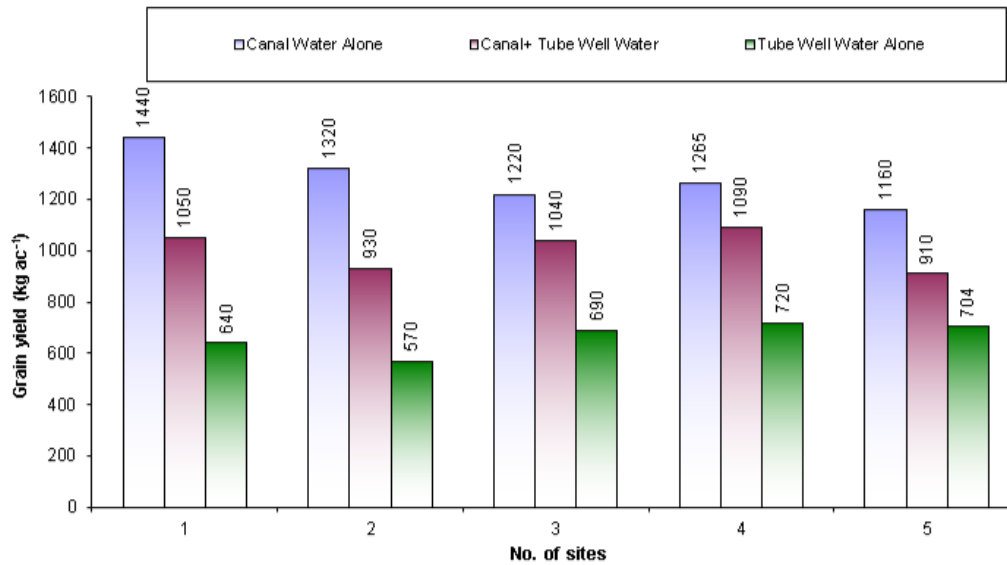


Figure 11: Comparison of wheat grain yield (kg/ac) under different irrigations strategies

**EC (ds/m) of soils of irrigated with associated tube wells under observation:** While observing the data of the five selected tube wells. The results shown in Table 5 and Table 6 reveals that the electrical conductivity (dS/m) increased with the utilization of tube well water but with the increasing depth the value of EC (dS/m) went decreasing in each of the three strategies applied.

Furthermore, cultivating the wheat crop it was also observed that because of the continuous application of water the solvent salts leached down and slight decrease in electrical conductivity (dS/m) was indicated. When the only tube well water was applied to the crops, the EC values observed were maximum of all with 6.28 dS/m. With the mixing of canal and tube well water the value of EC (dS/m) reduced at some extent as value shows 4.86 dS/m and lowest value of EC were observed as 3.15 dS/m when irrigation was applied by canal water only.

Table 5: EC dSm<sup>-1</sup> soils of five tube wells under observation before sowing of wheat

Site No	Canal Water				Tube Well Water + Canal Water				Tube Well Water			
	EC dS/m				EC dS/m				EC dS/m			
	Depth				Depth				Depth			
	1	2	3	4	1	2	3	4	1	2	3	4
1	3.65	2.63	1.69	1.34	4.86	2.78	1.79	1.32	5.83	4.25	3.73	2.99
2	3.15	2.46	1.51	1.16	4.73	3.41	1.53	1.20	6.28	4.09	3.82	3.1
3	3.82	2.81	1.60	1.38	3.55	2.71	1.58	1.13	5.48	4.36	3.1	2.8
4	3.30	2.28	1.68	1.31	4.67	2.67	1.36	1.08	5.86	4.61	3.66	2.95
5	3.20	2.16	1.56	1.0	3.70	2.32	1.21	0.95	6.08	4.79	3.91	3.31

Depth= 1= 0-15 cm, 2= 15-30 cm, 3= 30=45cm, 4= 45-60 cm

Table 6: EC dSm<sup>-1</sup> soils of five tube wells under observation after cropping of wheat

Site No	Canal Water				Tube Well Water + Canal Water				Tube Well Water			
	EC dS/m				EC dS/m				EC dS/m			
	Depth				Depth				Depth			
	1	2	3	4	1	2	3	4	1	2	3	4
1	5.45	5.15	4.0	2.00	6.55	4.46	1.95	1.60	6.85	4.43	2.36	1.92
2	4.36	3.95	3.55	1.85	5.35	4.18	1.62	1.22	5.65	3.63	1.91	1.13
3	4.96	4.42	3.89	1.80	4.22	3.73	1.96	1.20	4.45	2.72	1.38	1.05
4	5.28	5.03	3.92	1.61	4.60	3.22	1.32	1.10	4.99	2.49	1.26	0.98
5	5.06	4.64	3.44	1.05	5.05	4.07	1.72	1.13	5.38	2.72	1.33	1.2

Depth= 1= 0-15 cm, 2= 15-30 cm, 3= 30=45cm, 4= 45-60 cm

## V. CONCLUSION

**Conclusion:** From study it is concluded that Taluka Thul & Taluka Jacobabad are facing serious scarcity of the canal water, since 2002 irrigation rotation is being carried out and due to this majority of the farming community mostly rely on tube well irrigation rather than the canal water. Due to this serious scarcity of the irrigation water, heavy brackish utilization of tube well water without mixing it with canal water, yield potential of the area under study is very badly affected because of negligible use of soil amendment like gypsum, lack of improved soil management practices such as the uses of the farmyard manures and green manures. Wheat crops yields were found to be decreased very significantly in the portion of the land which were irrigated through tube wells water as compared to those which were irrigated with the canal water. Based on the chemical analysis the tube well water has found quite hazardous. When the canal water was mixed with the tube well netter results in terms of crops yield were obtained the said strategy also improve salinity controls and soil depletion in the study area.

### Suggestions:

- It is suggested that the integration of water resources management may be employed in the area of study.
- The available canal water can be used together with the tube well water.
- In order to improve soil structure/health the farming community should include farmyard manure and green manuring practices in crop nutrition program.
- To evaluate the impacts of tube wells water on crop yields and soil it is suggested that continuous monitoring of tube wells irrigated areas should be done by the government and non-governmental agencies.

## ACKNOWLEDGEMENTS

Authors are thankful to Mehran University of Engineering & Technology SZAB Campus Khairpur Mir's for providing necessary resources for carrying this research work.

## REFERENCES

- [1] G. Murtaza, M. Zia-ur-Rehman, I. Rashid and M. Qadir, Use of poor-quality water for agricultural production, *Research Developments and Saline Agricultures*, 7(1), 2019, 769-783.
- [2] GOP, *Economic Survey of Pakistan*, (Wheat: Ministry of Food, Agriculture and Livestock, Agriculture & Livestock Division, Government of Pakistan: Islamabad, 2014-15).
- [3] Ishwari, *Survey of public Tube wells* (ISHWARI; Publication No. 257, 2003).
- [4] A. Ghafoor, M.R. Chaudhry, M. Qadir, G. Murtaza and H.R. Ahmed, Use of drainage water for crops on normal and salt affected soils without disturbing bio-sphere equilibrium. *IRIS Pub*, 176 (2), 1997, 131-135.
- [5] A.S. Qureshi, *A Transient Model Approach to improve On-farm Irrigation and Drainage in Semi-arid Zones.*, Wageningen University, Netherlands, PhD, 2000.
- [6] M.A Haq, J. Akhtar, Tanwer-ul- Haq, M. Ibrahim, M. Khalid and Z.A Dasti, Use of Brackish drainage water for Rice product: *Proc. 3<sup>rd</sup> National Seminar on Drainage*, Pakistan, CA, 2004, 203-207.
- [7] A.B. Soomro and A.C. Hall, The Monitoring of Ground Water Table Levels and The Effect on Soil Parameters: A Case Study Based on Left Bank Outfall Drain (LBOD) Stage 1 Project, *International Symposium for the 21<sup>st</sup> Century*, Lahore, 17-18.
- [8] R.H. Qureshi and E.G. Barrett-Lennard, Saline Agriculture for irrigated land in Pakistan: *Handbook of Australian Centre for International Agriculture Research*, (Australia: Canberra, 1998) 327-342.
- [9] PWP., *Framework for Achieving the Pakistan Water Regime- 2025* (Pakistan Water Partnership: Pak, 2000).
- [10] N. Ahmed, *Water Resources of Pakistan* (Shahzad wazir, Gulberg-III: Lahore, 1993).
- [11] A. Tedeschi and R. Dell' Aquila, Effects of irrigation with Saline waters, at different concentrations on soil physical and chemical characteristics, *Agriculture and water management*, 77(2), 2005, 308-322.
- [12] M.S. Ali, S. Mahmood, M.N. Chaudhary and M. Sadiq, Irrigation quality of ground water of twenty villages in Lahore district, *Soil and Environment* 28(1), 2009, 17-23.
- [13] R. Anjum, A. Ahmed, R. Ullah, M. Jahangir and M. Yousaf, Effect of soil salinity/sodicity on the growth and yield of different varieties of cotton. *International Journal of Agriculture and Biology*, 7(4), 2005, 606-608.
- [14] M. Hasan, Y. Shang, G. Akhter and M. Khan, Geophysical investigation of fresh saline water interface, A case study from South Punjab, Pakistan. *Ground Water. The Australian soil classification*, 55(6), 2017, 841-856.
- [15] M.A. Shakir, The use of saline waters for crop production, *FAO irrigation and drainage paper*, 48(3),

- 2017, 483-488.
- [16] B. Kumar, V. Gangwar and S.K.S Parihar, Effect of saline water irrigation on germination and yield of wheat (*Triticum aestivum*) genotypes. *Agrotechnology*. 6(1), 2017, 156-159.
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