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Evaluation of Soil Salinity and its Impacts on Agriculture: Nexus of RBOD-III, Pakistan

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Abstract: Agriculture is a primary economic activity of man since long period; agriculture is a huge platform to provide the jobs in this sector. As agriculture simply financial records for 4.2 % of direct service in developed nations, at present employs over 52 % of the labor force in the Africa, and 59 % in Oceania. In this sector employs over 1.3 billion people all over the world or near to 40 % of the global labor force. Over the fifty countries, agriculture employs half of the total population and even 75 % in the pitiable nations.Soil is a backbone of economy of an agricultural country, which increases not only the GDP but also provides the childhood and source of income in rural areas. Agriculture of any region depends upon the Soil fertility, it is natural resource which provides the food and helps to maintain eco-system and supportsus to control on climate change. Soil salinity is a disease or cancer of soil, by this disease annual production of different crops and fruits are reducing day by day. District Kamber-Shahdadkot is also facing this disease due to the construction and mismanagement of Right Bank Outfall Drain-III (R.B.O.D-III). A six kilometers long belt of Kamber-Shahdadkot along the both sides of RBOD-III is webbed by the soil salinity. Where, farmers are seeking for a grain of rice and wheat. For the recuperation of soils fertility, a scientific experience was done in laboratory on the three parameters pH, Electric Conductivity (E.C) and Total Dissolved salts (TDS).

Keywords: Evaluation, Soil salinity, Agriculture, RBOD-III, Pakistan

1. INTRODUCTION

Geographical location of Right Bank Out Fall Drain-III (RBOD-III) is latitude of 27º-54º & 28º-40º' and longitude of 67^0-39^0 and 68^0-51^0.The research area is stretched the area of the Balochistan and Sindh. In Sindh, Jacobabad and Kamber Shahdadkot districts are covered the RBOD and Districts Nasirabad and Jafarabad of Balochistan also covered (WAPDA, 2017). The drainis an out let of agriculture land of Baluchistan crossing from Sindh, *Kamber-Shahdadkot* and *Dadu* are the most effect district of Sindh province, where it's located. R.B.O.D-III crossing from western margin of above districts nears the foot hill area of Khirthar Mountain range, where Canal/river irrigation system is not available. The drain is at footprint of old Western Nara Canal (WNC). A part from this, two other drains MNV and Haridrian drains are journeying along with R.B.O.D-III (Chandio and Anwar 2009). The RBOD-III is a just like lake of salts where different types of salts are obtainable. It is observed thata six kilometers narrow strip belt (1436km^2) or 354843.3 acres land of the research area at both sides of RBOD-III is webbed by the soil salinity as shown in **(Fig 1),** (Chandio, 2016). There are three main sources of that salts:

1: During flooding and rain, the water coming from the peaks of Khirthar Mountain. The Khirthar Mountain is natural boundary between Sindh and Baluchistan Province, the mountain is inter-connected with Baluchistan Plateau then Iranian Plateaus. The rain water coming from Iranian Plateaus to Baluchistan Plateau reaches at Khi rthar after that by rain rills it mix in water of R.B.O.D-III, Hamal Lake, Manchhar Lake and other local drain canals of the research area.

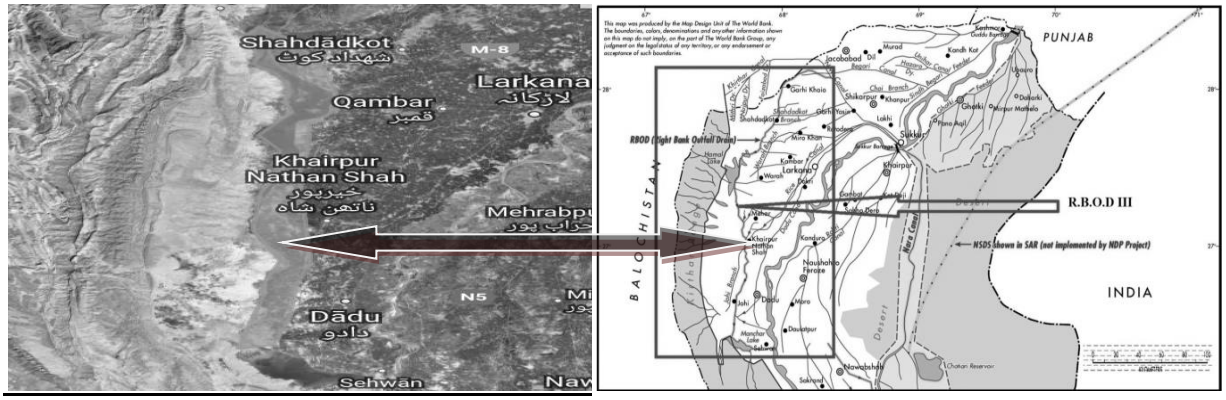

Fig. 1: Geographical Location of RBOD-III and salt affected soil

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2: In facts, RBOD-III starts from the barren lands and plain area Baluchistan near to Sindh border and it's collected the different salts from barren lands

3: local drains like Miro Khan Drain, Shahdadkot drain and lot of other local drains are cascade the outlet the Drain water in RBOD-III(Anwar, and Chandio 2012).

Investment of federal government

On the saltiness waste control front, an enormous second RBOD extend in Sindh was embraced to Canal away saline water from Sindh and Balochistan that was beforehand being surpluses into Manchhar Lake. This scheme (RBOD -II) goes for developing RBOD- I from close Manchar to the Arabian Sea, jointly with additional saline water gathered along its length. It is planned both to restore Manchhar Lake and furthermore to evacuate saline water along the whole right bank of the Indus in Sindh. With a limit of 4,000 cusecs, the scheme was begin in 2002 at add up to cost of Rs 10 billion and is near to conclude (Annual 2001-2). This financed scheme was supported by the Government of Pakistan and was implemented by the Government of Sindh. **(Table 1)**

Table 1: Water Chemistry of R.B.O.D-III, Miro Khan Drain and Heridian Drain

S. No	Date of collection	Time	pH	Electric Con (ds/m)	TDS (PPM)	Location
1.	20.10.2014	11.15	8.1	3.2	2297	R B O D[111]
2.	20.10.2014	11.45	7.7	3.4	2390	
3.	20.10.2014	13.10	7.8	4.6	2185	
4.	20.10 .2014	13.30	8.0	4.6	2415	
5.	21.10.2014	09:00	7.7	3.7	2285	Miro Khan Drain
6.	21.10.2014	10:30	8.1	3.2	2330	
7.	21.10.2014	11:10	7.5	3.8	2390	
8.	22-10-2014	11:00	7.8	4.3	2230	Hariadian Drain
9.	22-10-2014	11:30	7.9	4.1	2340	
10.	22-10-2014	12:15	8.0	4.3	2170	

Soil of the region is very fertile, too able to grow any type of crop. At present, this water has started to keep the negative effects on soil. It is observed that first cropping year in the region farmers are taking bumper productions, but slowly the production reducing year by year. After seven to ten years, soil fertility will have washed out.

Table 2: An area and wheat production of five years (2012 to 2016)

Years	2012	2013	2104	2015	2016
Area and production (kgs) (one acres area)	1200	1040	920	700	450
Note: 62.5% wheat production reduced in five years					

Now, the situation is the worst, after erroneous construction of this project, the agriculture fields are completely under the threat of soil salinity. Due to non-availability of canal irrigation system in the region, growers are accomplished to use the water of RBOD-III for wheat and other seasonal crops a long both banks of RBOD-III. The **(Table 2)** is showing an area and wheat production of five years by the use of drain water; it is also showing the reducing ratio of production year by years.

Table 3: Chemistry of Soil taken from of the study area

S. No.	Latitudes(N)	Longitudes (E)	El: (ft)	pH	EC (ds/m)	TDS
1.	27º 39' 07.05''	68º 00' 18.57"	160	8.0	1.50	960
2.	27º 39' 36.40"	68º 00' 57.27 "	155	8.0	1.25	1002
3	27°30'0.61"N	67°55'0.06"E	155	7.9	1.3	1190

Here, **(Table 3)** showing the soil analysis before the experiment, where pH, Total Dissolved Salts (TDS) and Electric Conductivity (EC) is going to elevate risk level. If this continuity and may not be stopped that the study area will be converted in Drain Lake like Manchhar and Hamal Lake. Once, Lake Manchhar and Lake Hamal were sweet water lakes provide a huge amount of fish, now chemistry of both lakes has been changed only due to outlet of RBOD-III (Fatima, *et.al.*, 2016).

2. MATERIAL AND METHOD

An acre of land was selected near to the Warah Canal from study area, where river/canal water was at the distance of one kilometer. For the laboratory analysis, ten holes were drilled at the different places of research area for composite soil sampling. A hole was divided into three horizons, horizon-***A*** (Surface depth) which is 0-15 cm deep, horizon-***B*** (Mid depth) 15-30 cm deep and last horizon-***C***(Bottom depth) 30-45cm

deep. Similarly, soils of Horizon-***A*** of all ten holes were mixed in one plastic bag and soils of Horizon-***B*** of all ten holes were mixed in another purified plastic bag, similarly soils of horizon-***C*** of all ten holes were mixed in another plastic bag. So into those all ten holes only three samples were calculated from the selected area.

After field collection, those samples were air dried in a separate chamber of laboratory room. Air dried soil was converted in powdered form by an especial grinder machine. The purpose of this whole process is to calculate the pH, Total Dissolved Salts and Electric Conductivity of the soil.

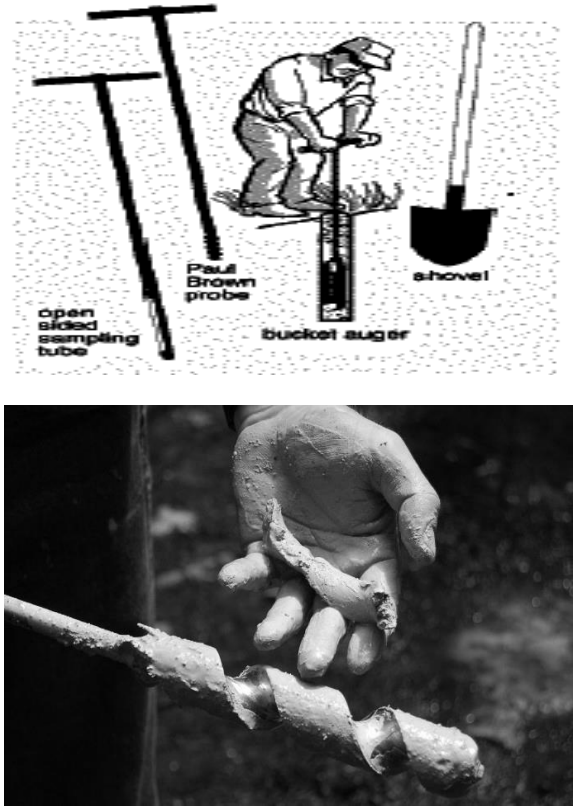

Fig. 2: Field tools of soil sampling

This experiment was based on the Leaching Fraction (L.F) in this process an extra amount of river water from Warah Canal irrigated over the salt affected soil (Self 2010).After five to six time irrigation of river/canal water, the salts are sinking down in bottom at 20 inches beneath the surface. There are major yields are cultivated at the study area; Wheat and Rice, both crops cannot penetrate more than six to ten inches in the depth due to short roots. Therefore this type of experiment is most effective and successful in the region. So that water of Warah canal was used for this experiment and the water is most effective for soil fertility.

In the laboratory, tests of pH, TDS and EC were measures by pH meter, TDS meter and EC meter, such type of instruments are already easily available. In the laboratory, 60 grams of powdered and filtered soil mixed in 300 ml of distilled water in conical flask. For mixing of sampling, samples were detained in reserve tightly in the Mechanical Shaker in conical Flasks for half an hour only. A net type filter paper was used for pure filtration of soil testing. After that TDS, EC and pH of the sampled soil tests were conducted. Here, pH was recorded by Hanna instruments HI 8014pH meter, E.Crecorded by Hanna instruments HI 98304, E.C tester and TDS were recorded by the same company HI 98301TDS meter (Anwar and Chandio. 2012).

3. RESULTS

Approximately 16.50 million acres of the country is salt influenced soil, by this calculation 60% area is secured by saline-sodic/sodic and cannot be restore by Leaching Fraction with any concentration utilization (Ghafoor, *et al*, 2011). Recovery of salt affected soils contains the depleting of solvent salts besides modify in its Physical Property (Aggasi, *et. al.*, 1981). The design of elevated amount of Ca2+Mg2+ to collectivization obsession (R-Worth) could power decrease in term to end reclamation though outgoing volume of water is necessary (Reeve, and Bower, 1960; Reeve, and Doering, 1966 Mohite, and Shingte, 1981). The gypsum can maintain electrolyte focus rational for better Physical as well as in Chemical properties of soils for long periods (Biswas, 2005).

The goals of the study were to observe the long time beneficial in irrigation system of the region as well as in the country by Leaching Fraction from the water Warah link canal. Tests were completed by parallel of pH, EC, and TDS of leached soil and to exhaust water at the study area. Here, every soil sample has its own depth level as mentioned in material and method and given in following tables.

Table: 4 Result of TDS, EC and pH(0-15 cm depth)

Sample No.1 surface (0-15 cm)	pH	EC (ds/m)	TDS
ECd	8.1	1.75	680
ECw	7.3	0.7	160
L.F	7.5	1.25	290
Positive Variation	0.6	0.5	390
Positive change %	7.4	28.5	57.3

Table: 5 Result of pH, EC and TDS (15-30 cm depth)

Sample No.2 Mid depth (15-30 cm)	pH	EC (ds/m)	TDS
ECd	8.0	1.25	590
ECw	7.3	0.7	160
L.F	7.5	1.25	270
Positive Variation	0.5	1.25	320
%	6.25	0.0	39

Table: 6 Result of pH, EC and TDS (30-45 cm depth)

Sample No.3 Bottom depth (30-45 cm)	pH	EC (ds/m)	TDS
ECd	7.8	1.25	470
ECw	7.3	0.7	160
L.F	7.4	1.0	220
Positive Variation	0.4	0.25	250
%	5.1%	20%	53.1%

4. CONSCULSION

The soil of the research area was very productive, but now Physical and Chemical Properties of the soil has been changed since last two decades, only due to use of saline irrigation water of RBOD-III, Harridarian Drain, Miro Khan Drain and Rain Water Rills (RWR) by local growers. The quality of the soil was not able to cultivate.

Here, in the region river water is available through the Warah Canal to irrigate the region, but the canal is not sufficient for the whole region. The research area is a remote area of the Pakistan, where local formers are not aware of latest and advanced technologies in the field of irrigation and agriculture. Therefore, for the easiest of local peasants, the Leaching Fraction (R.F) is strong and effective method to maintain the fertility of the soil. Resultantly, Warah Canal is the most effective source for Leaching Fraction. This reflects the actual issue that related to soil conditions. This research identifies the best approach proposal.

Soil fertility can easily be maintained by the Leaching Process. Therefore, the water should be at level international standard quality, so the quality of water of Warah Canal is at standard of International Level (SIL) and can be used easily for applying Leaching Fraction in the region, by this way, additional volume of water added at the area of disturbed soil for the purpose of wash out the salts.

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