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Spatial and Temporal Changes in Salinity of Arable Lands in Shah Bandar Tehsil, Thatta District, Sindh.

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Aims and Objectives

- Present study is aimed to evaluate spatial and temporal variation in soil salinity and sodicity in Shah Bandar Tehsil during Post and Pre-monsoon seasons of 2011-2013.

- To understand and quantify extent and pattern of soil salinity (ECe) and sodicity (SAR), samples of top and sub soil layers of Shah Bandar Tehsil were collected.

- Another objective was to assess the effects of 2010 and 2011 floods and sea water intrusion on soil salinity and soil fertility in the study area.

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Study Area

- The study area lies between latitude 24º 12′ to 24º 24′ N and longitude 67º 35′ to 67º 59′ E, covering the coastal parts of Shah Bandar tehsil, Thatta district Sindh (Fig. 1).
- It is surrounded by Hyderabad and Dadu districts in north, Arabian Sea in south, Indus River in the east and Karachi district in the west.
- River and coastal plains are two main landform types in the area.

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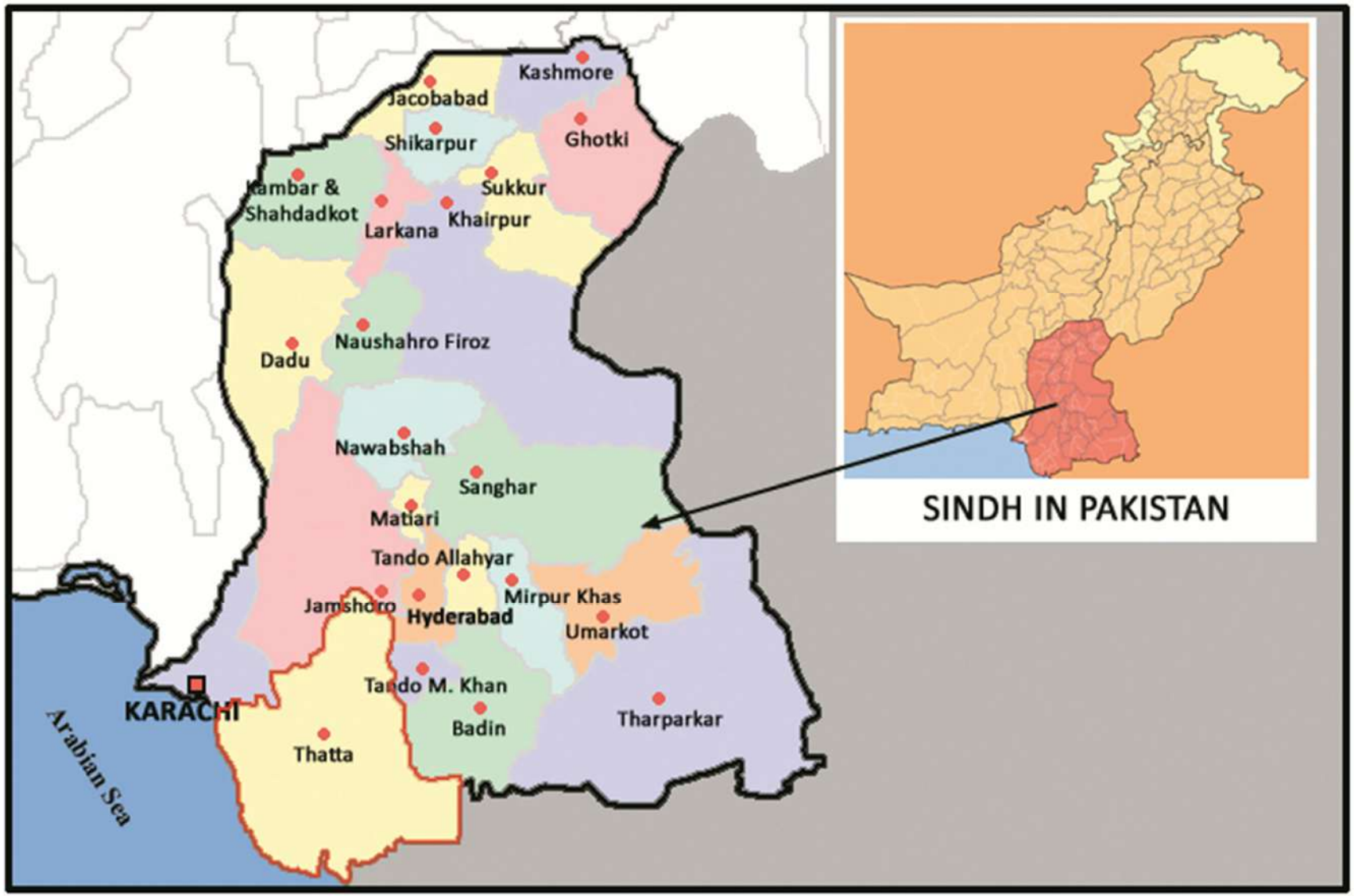
Study Area



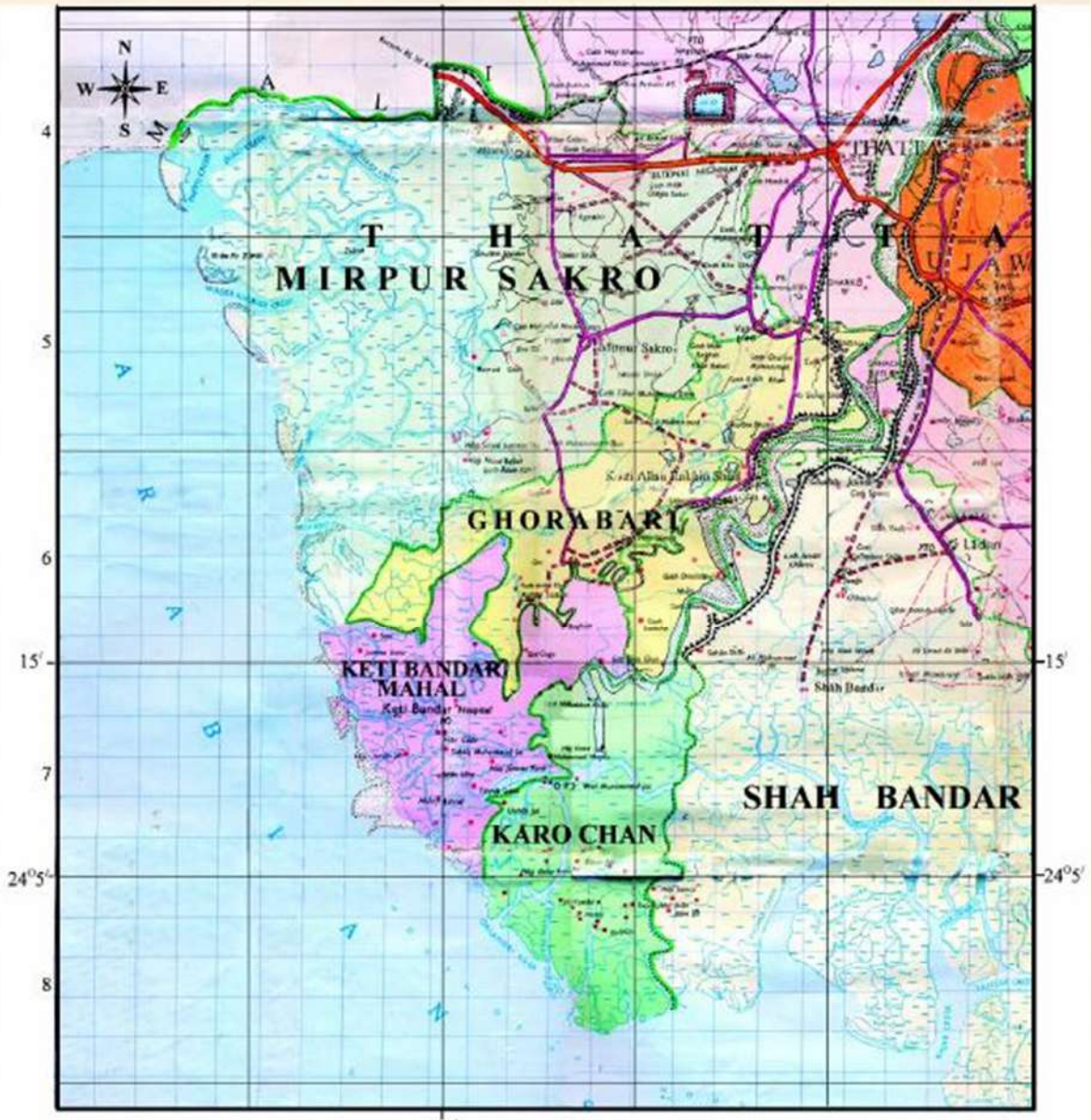


Fig. 1

THATTA DISTRICT

Scale 1:325,000

Kilometers 0 5 10 20 30 40 Kilometers 50

CONTOUR INTERVAL 100 METERS

(Fig. 1)

Climate

- The climate of the area is arid and tropical marine. Temperature ranges from about 25 ℃ to 40 ℃ and average rainfall does not exceed 200 mm (8 inches) per annum

- Canals are passing through the study area, which receives water for few months during a year.

Problems Faced by Agriculture Sector

- Groundwater is highly saline and water table depth ranges from 2-25 (ft) from general ground surface depending upon topography.
- Cultivation is based on monsoon rains and water from perennial/non perennial canals.
- The flooding with monsoon rains and water logging is also common.

Problems Faced by Agriculture Sector

- Flood water keeps standing for 3-4 months in depressions due to uneven topography, making the cultivation not possible in the area.

- The coastal belt is under regular salt water flooding and sea water intrusion, causing increased soil salinity and sodicity, which is badly affecting the soil fertility and crop productivity in the area (Fig. 2).

Problems Faced by Agriculture Sector

- The construction of dams along Indus River caused reduction of fresh water flow and sediments resulting in

  - ✓ Increased soil and groundwater salinity
  - ✓ Encroachment of Arabian Sea into the Indus Delta.

- Deteriorating the soil fertility to the extent that cultivable land is fast changing into barren areas.

- As a result, locals are migrating for their livelihood instead of continuing farming.

Fig. 2: Barren land near Siddique Punlano site, Daulatpur union council, Shah Bandar.

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Materials and Methods

- Forty eight soil samples were collected from six sites in Shah Bandar at depths of 0-12" and 12-24" during Post and Pre-monsoon seasons of 2011-2013.
- Extracts of soil samples were analyzed for determining pHe, ECe, cations and anions.
- Sodium adsorption ratios (SAR) of these samples were also calculated.
- Spatial maps along with sample locations were plotted to indicate temporal variation in soil salinity (ECe) and sodicity (SAR) during Post/Pre-monsoon seasons of 2011-2013.

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Soil Texture

Table 1. Location and texture of soil samples from Shah Bandar (2011- 2013).

Grid	Site	Village	U.Council	Depth	GPS		Textural Class	Mechanical Analysis		
				Inch	N	S		Sand%	Silt%	Clay%
58	1	Siddique Punlano	Daulatpur	0-12	24 12 27	67 53 23	Silt loam	20.4	60.8	18.8
				12-24	24 12 27	67 53 23	Silt loam	17.2	54.0	28.0
57	2	M.Ismail Babro	Daulatpur	0-12	24 14 23	67 54 01	Silt loam	17.2	70.0	12.8
				12-24	24 14 23	67 54 01	Silt clay loam	17.2	52.0	30.8
56	3	H. Jam Chandio	Jungo	0-12	24 17 44	67 55 36	Silt clay loam	17.2	48.0	36.8
				12-24	24 17 44	67 55 36	Silt clay loam	17.2	47.6	34.8
				24-36	24 17 44	67 55 36	Silt loam	16.8	60.4	22.8
				36-48	24 17 44	67 55 36	Silt clay loam	16.8	48.4	34.8
55	4	Syed Jalal	Goongani	0-12	24 17 44	67 55 35	Silt loam	20.8	68.4	10.8
				12-24	24 17 44	67 55 35	Silt loam	30.8	58.4	10.8
54	5	Ghar Moon	Chohar Jamali	0-12	24 23 29	67 58 26	Silt loam	16.8	74.4	8.8
				12-24	24 23 29	67 58 26	Silt loam	16.8	64.4	18.8
59	6	W. Chutto Ratlo	Chohar Jamali	0-12	24 24 40	67 59 35	Clay	26.8	32.4	40.8
				12-24	24 24 40	67 59 35	Siltloam	20.8	60.4	18.8

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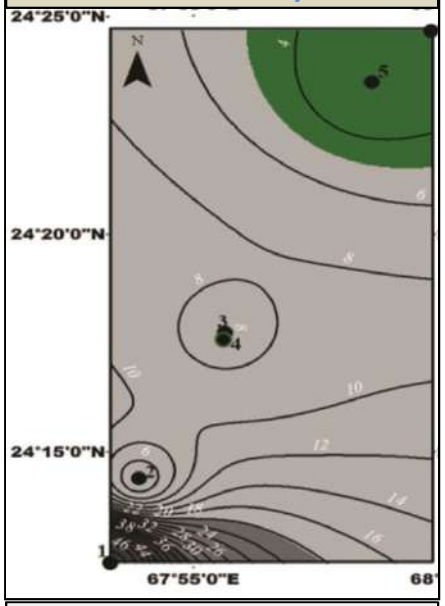
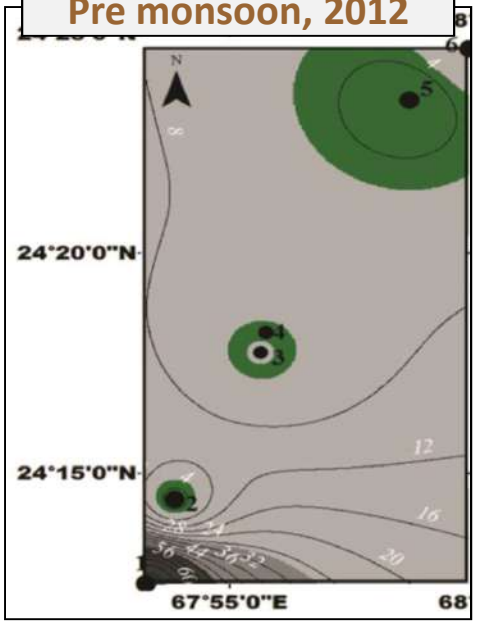
Spatial Maps of Soil Salinity (ECe)

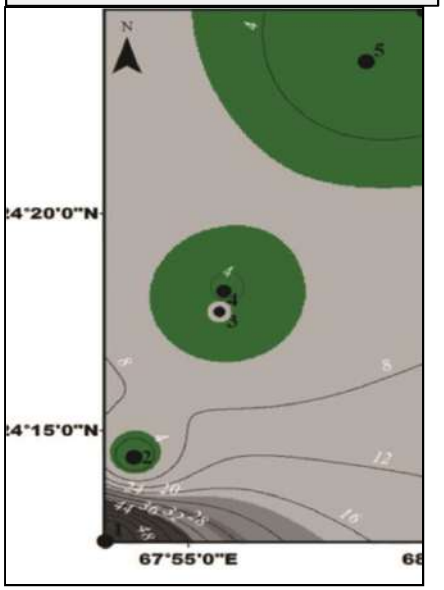
Post monsoon, 2011



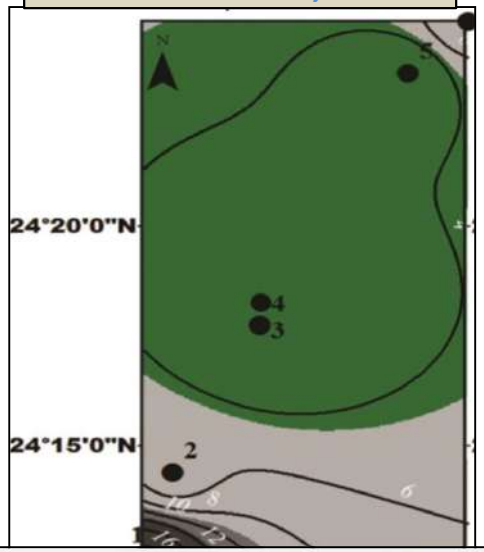
Pre monsoon, 2012

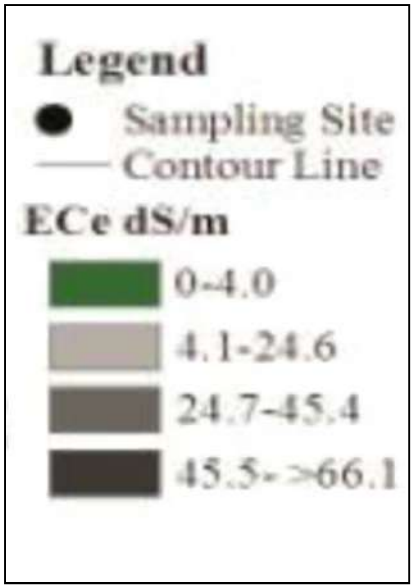


Pre monsoon, 2013



Post monsoon, 2013





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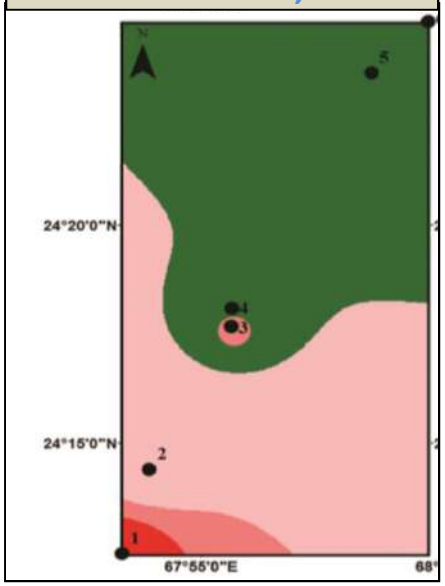
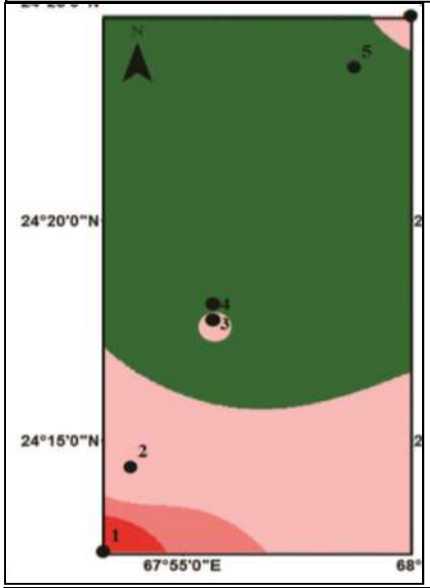
Spatial Maps of Sodicity (SAR)

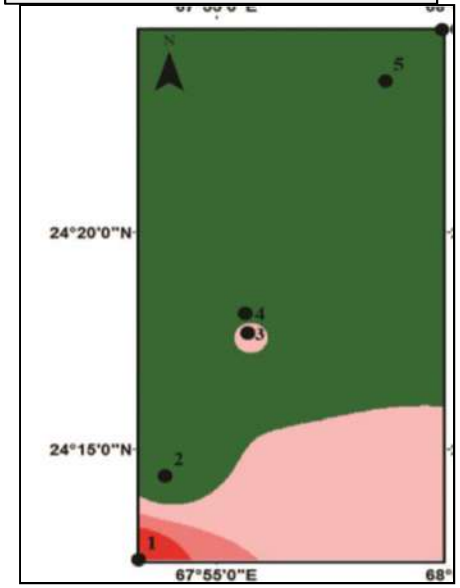
Post monsoon, 2011



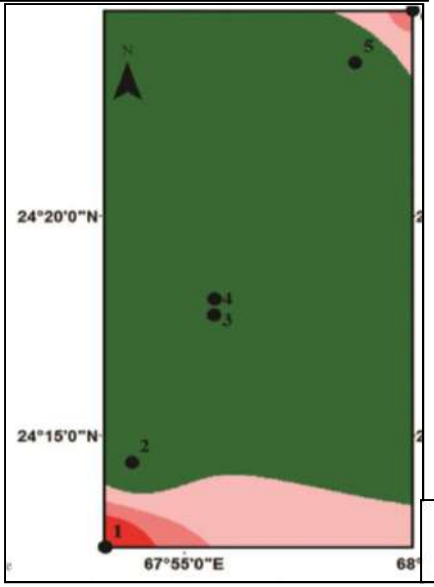
Pre monsoon, 2012

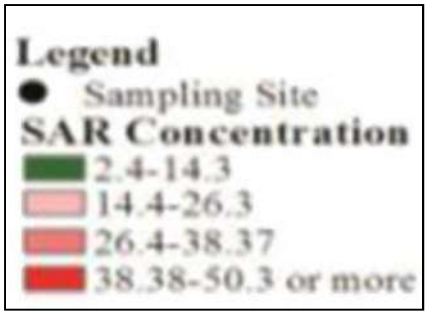


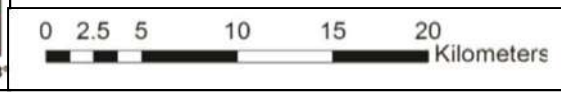
Pre monsoon, 2013



Post monsoon, 2013







Isotope Analysis of Ground Water

Tehsils	Grid #	Depth (Ft)	δ 18O (‰)	δ 2H (‰)	Contribution Of Arabian Seawater ^{18}O (%)	Contribution Of Arabian Seawater ^{2}H (%)
Shah Bandar	55	25	-8.81	-58.39	7.89	12.15
	54	20	-8.86	-60.63	7.50	9.37
K. T.Bandar	49	20	-7.73	-52.36	16.51	19.64
	50	20-25	-8.07	-52.41	13.80	19.58
	51	20-25	-6.23	-43.20	**28.47**	**31.01**
Ghora Bari	37	40	-8.09	-55.98	13.64	15.14
	43	25	-8.24	-55.59	12.44	15.63
	46	25	-6.65	-45.54	25.12	28.10
	47	25	-7.48	-53.06	18.50	18.77
MirPur Sakero	3	25	-6.83	-47.38	23.68	25.82
	4	22	-7.91	-56.22	15.07	14.85
	11	35	-6.55	-45.61	25.92	28.02
	13	25	-7.18	-50.73	20.89	21.66
	17	20	-8.26	-54.42	12.28	17.08
	19	50	-8.33	-57.90	11.72	12.76
	20	25	-6.84	-48.34	23.60	24.63
	24	25	-7.89	-53.07	15.23	18.76
	25	25	-7.76	-55.17	16.27	16.15
	27	45	-8.10	-54.00	13.56	17.60
	33	22	-7.36	-50.59	19.46	21.83
	34	32	-6.93	-48.21	22.89	24.79
	35	25	-7.90	-53.51	15.15	18.21
	39	30	-7.43	-50.69	18.90	21.71
	40	25	-8.06	-55.55	13.88	15.68

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Conclusion

- Soil salinity in Shah Bandar Tehsil varies from area to area and season to season.
- Soil sodicity and salinity were high during pre monsoon than post monsoon season due to severe arid climate, shortage of canal water, capillarity of saline ground water, salt water /tidal flooding and sea water intrusion.
- It is concluded that soil quality improved and the area under cultivation also increased due to significant decrease in soil salinity after the floods of 2010 and 2011.

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