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Seasonal Variations in Soil Conditions, Its Classification and Mapping of Dry Sub Tropical Region of Uthal, District Lasbela

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Abstract
The study on soil classification and seasonal variation was carried out during 2011-12 in Tehsil Uthal, District Lasbella (Balochistan). The water and soil samples were collected and subjected to determine for various physico-chemical properties and accordingly the results were formulated and compared with standard values. In winter soil EC in Zone 1, Zone 2, Zone 3 and Zone 4 area was 2.218, 1.99, 2.43 and 1.22 dS m^{-1},pH value 8.1, 8.3, 8.3 and 7.8, HCO_3^- 2.0125, 1.725, 1.675 and 2.5875 meq L^{-1}, Na^{2+} 13, 12, 11.4125 and 14meq L^{-1} ,Ca^{2+} 7, 6, 6 and 7meq L^{-1} while the TDS in soil samples were 1571, 1638, 1902 and 837, respectively. In summer soil EC in Zone 1, Zone 2, Zone 3 and Zone 4area zones was 2.27, 2.04, 2.66 and 1.29 dS cm^{-1}, pH value 8.7, 8.4, 8.4 and 8.0, HCO_3^-1.7375, 1.675, 1.5375 and 1.85meq L^{-1}, Na^{2+} 13, 13, 12 and 16meq L^{-1},Ca^{2+}6, 6, 6 and 7meq L^{-1} while the TDS in soil samples were 1605, 1713, 1001 and 952, respectively. Average value of EC_e of 2.04 dSm^{-1}. The EC_e values ranged 1.08 to 3 dSm^{-1}. The average values of EC_e at the given depth verify that marginal salinity was present in the soil. This may be due to the leaching of salts to the deeper layers. The average value of SAR is 9.18. The SAR ranged from 6.8 to 12.2. The ratios are less than 13 which show that concentration of Na^+ ions to that of Ca^{+2} and Mg^{+2} is low. The average value of SAR is 9.18. The SAR ranged from 6.8 to 12.2. The ratios are less than 13 which show that concentration of Na^+ ions to that of Ca^{+2} and Mg^{+2} is low. This shows improvement in soil.
Keywords: Soil, Electrical Conductivity, SAR, Summer, Winter, Zones, Mapping

INTRODUCTION

Soil salinity and sodicity are two main factors which limit production of crops in irrigated agriculture. Stalinization is the process of buildup salts in soil profile to an extent where they limit crop production. Salinization is a worldwide problem, particularly in irrigated lands, which are extensively irrigated and are poorly drained. at the global scale more than 77 mha (million hectares) of land are salt-affected and about 43 mha are attributed to secondary salinisation. Estimates indicate that about one-third of the irrigated lands in the major countries with irrigated agriculture is badly affected by salinity or is expected to be salinised in the near future Salinity in soil gains importance when the amount of salts exceeds the tolerance level of crops (FAO, 2007). The salinisation is inevitable and likely to expand because around 70% of the available surface water with varying degree of quality used for irrigation worldwide is continuously adding millions of tons of salts to productive lands. In future, to cope with the rapid population growth and increasing food demand, more dry lands will be put into agricultural production or cropping intensity must increase manifolds. Such extensive cropping will be mainly achieved through irrigation and thus accelerates the salinisation risks (Metternichet and Zinck, 2003).Due to high evapotranspiration rate excessive amount of salts accumulates in poorly drained soils (Wang et al., 2008). Soil sodicity becomes important when its concentration effective exceeds 15%. The main causes of the soil sodicity which decreased the crop production are degraded soil structure, decreased soil hydraulic conductivity, soil aeration, and infiltration rate, and increased soil pH to 8.5 or higher are (Richards, 1954). Managing salinity in irrigated agriculture is crucial for minimising its negative environmental impacts and for ensuring the long-term sustainability of irrigated agriculture. It demands establishing rapid monitoring systems that help develop sustainable management plans. Remote sensing offers several advantages over the conventional proximal methods to map and predict areas at salinity risk (Abbas et.al 2013). Soil salinity and sodicity obscure growth of many field and horticultural crops. Spatial and temporal variations of these attributes should be known to avoid their impacts on plant growth. A multivariate analysis along with geostatistical analysis can aid to evaluate impact of soil management and land use change on soil EC/ESP as well as soil variables having correlations with EC and ESP (Gulera et.al, 2014). This study was carried out to find Soil Classification and mapping a part of Lasbela Region Pakistan, Seasonal variations in sodicity of soil oand Region and Seasonal variations in Salinity of soil.

Study Area

The study was carried out in Tehsil Uthal, District Lasbella. It lies in south of Balochistan; it is dry sub-tropical region. Zone 3 is lying between the latitudes of 25^o 66 North and the longitudes of 66^o 37 East. The soil texture

Zone 3 is alluvial, and is composed of light loose clay, mixed with fine sand.

Figureure 1 Study Area Map

MATERIALS AND METHODS

Due to the dominance of Banana trees in the area and their sensitivity to salinity, we have taken all soil samples from the banana plantation. Soil samples were collected in pre and post moonsoon 2012 to assess a possible seasonal effect and evaluate the vertical movement of salts between seasons. The area has been divided in 4 zones. Surface samples were taken at 32 sites located in a representative Banana production area. Data was analyzed on average basis.The data of the soil in the region has been collected to observe the changes in soil salinity and Alkanity for a given soil depth. Electrical Conductivity (EC), Total Dissolved Salts (TDS) and pH in soil saturation extract were determined by portable conductivity meter. The concentration of Na was determined in the water sample by using flame photometer using appropriate standard following Richard (1954). $Ca^{+} + Mg^{++}$ was be determined by Titration method. SAR was determined by determination of sodium through Flame photo meter by using standard procedures**.** The readings taken by GPS in degrees and minutes were changed to meters and kilometers using Google Earth software. Soil test values at un-sampled locations were interpolated using geostatistical technique of kriging and detailed contour maps were prepared at smaller grid spacing by using Surfer 32 (Rashid and Bhatti, 2005). The data was statistically analyzed by using RCBD (Steel and Torrie, 1980).The means were compared by using the LSD test at probability level of $P<0.05$.

RESULTS AND DISSCUSION

Geochemical Status of Soil in Winter

The soil samples initially collected (Winter) were subjected to determine for EC, pH,TDS,SAR, HCO_3^-, Na^{+2}, $Ca^{+2} + Mg^{+2}$ and showed significant ($P<0.05$) variation in these soil properties between different zones of the study area. The data in Table-1 indicated that the soil EC in Zone 1, Zone 2, Zone 3 and Zone 4area zones was 2.218, 1.99, 2.43 and 1.22 dS m^{-1},pH value 8.1, 8.3, 8.3 and 7.8, HCO_3^- 2.0125, 1.725, 1.675 and 2.5875 meq L^{-1}, Na^{2+} 13, 12, 11.4125 and 14meq L^{-1} ,Ca^{2+} 7, 6, 6 and 7meq L^{-1} while the TDS in soil samples were 1571, 1638, 1902 and 837, respectively.

Table 1. Geochemical Status of Soil in Winter

Parameters	SE	LSD	Zones			
			Zone 1	Zone 2	Zone 3	Zone 4
EC (dSm^{-1})	143.07	297.53	2.218	1.99	2.43	1.2
pH	0.1149	0.239	8.1	8.3	8.3	7.8
HCO_3^- (meq/l)	0.316	0.6571	2.0125	1.725	1.675	2.5875
Na^{2+} (meq/l)	0.5459	1.1354	13	12	11.4125	14
$Ca^{+2}+ Mg^{+2}$ (meq/l)	0.2139	0.4449	7	6	6	7
TDS	136.25	283.34	1571	1638	1902	837

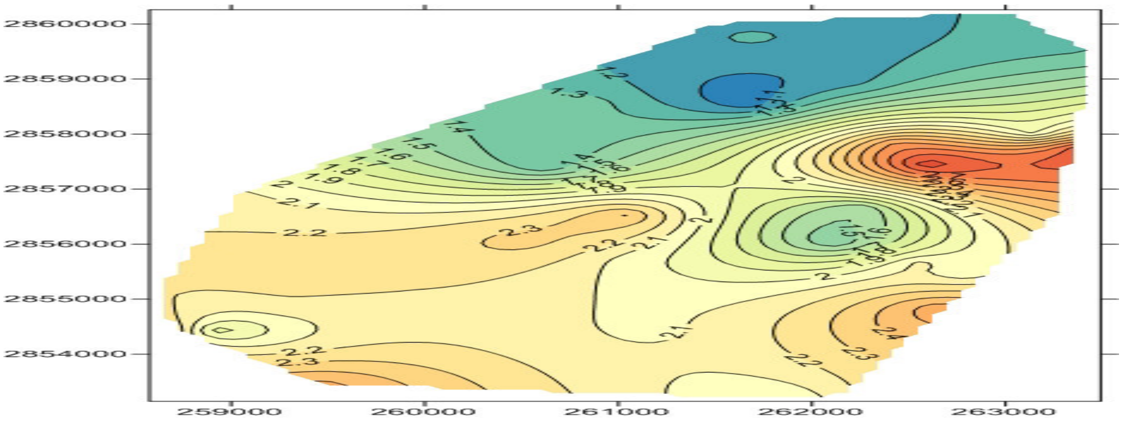


Figure 2 Electrical Conductivity Map in Winter

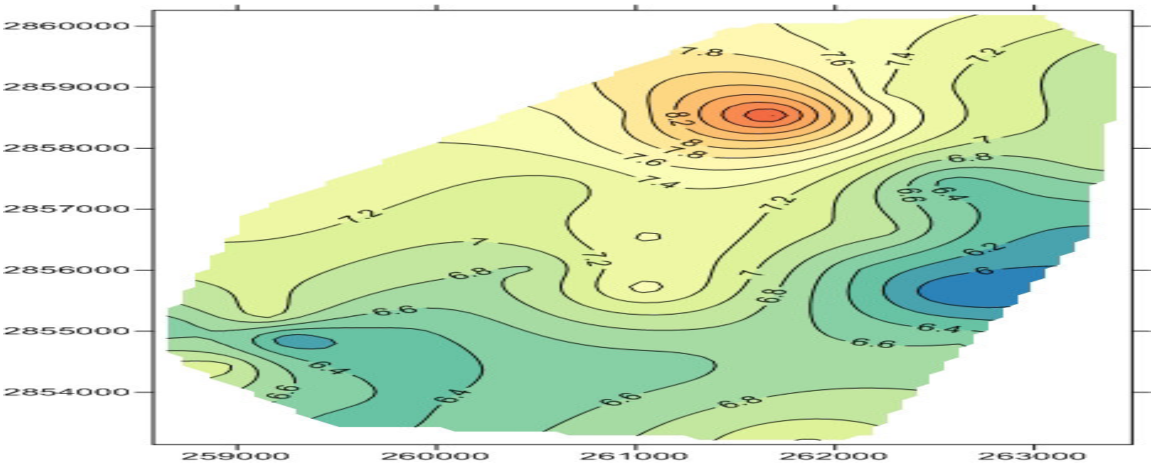


Figure 3 SAR Map in Winter

Geochemical Status of soil in Summer

The second sample of the soil (Post Monsoon) was collected and also examined for EC, pH, HCO_3^-, Na^{2+}, Ca^{2+}, SAR, TDS and suggested significant ($P<0.05$) difference in the physico-chemical soil properties between different zones. The data in Table-2 showed that the soil EC in Zone 1, Zone 2, Zone 3 and Zone 4area zones was 2.27, 2.04, 2.66 and 1.29 dS cm^{-1}, pH value 8.7, 8.4, 8.4 and 8.0, HCO_3^-1.7375, 1.675, 1.5375 and 1.85meq L^{-1}, Na^{2+} 13, 13, 12 and 16meq L^{-1},Ca^{2+}6, 6, 6 and 7meq L^{-1} while the TDS in soil samples were 1605, 1713, 1001 and 952, respectively.

Table 2. Geochemical Status of Soil in Summer

Parameters	**SE**	**LSD**	**Zones**			
			Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
EC (dSm^{-1})	191.64	398.53	2.27	2.04	2.56	1.29
pH	0.1329	0.2764	8.7	8.4	8.4	8
HCO_3^- (meq/l)	0.1214	0.2524	1.7375	1.675	1.5375	1.85
Na^{2+} (meq/l)	1.4945	3.108	13	13	12	16
Ca^{+2}+ Mg^{+2} (meq/l)	0.2106	0.4379	6	6	6	7
TDS	132.22	274.97	1605	1713	1001	952

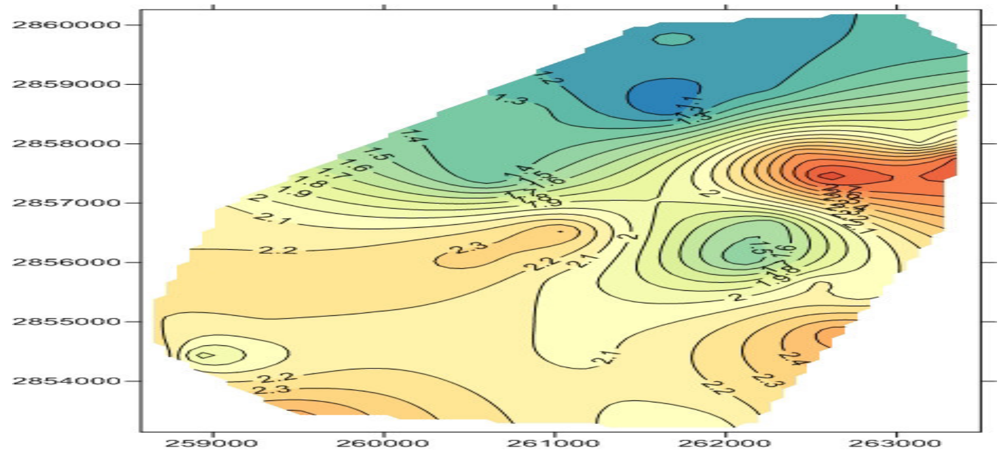


Figure 4 Electrical Conductivity Map in Summer

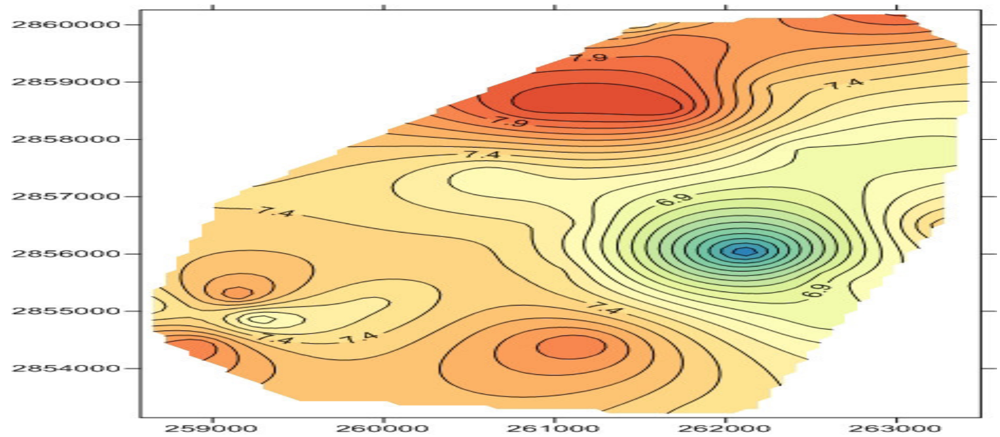
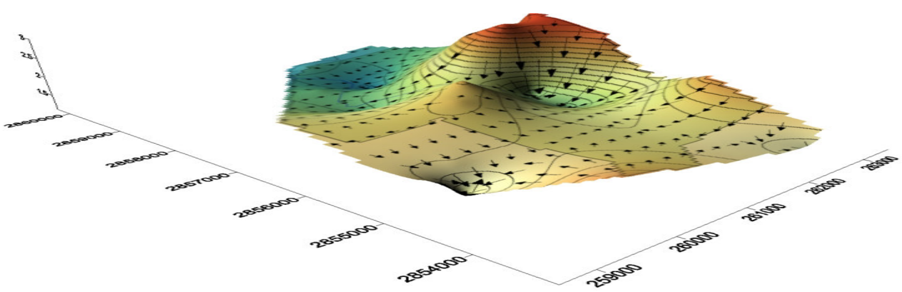


Figure 5 SAR Map in Summer

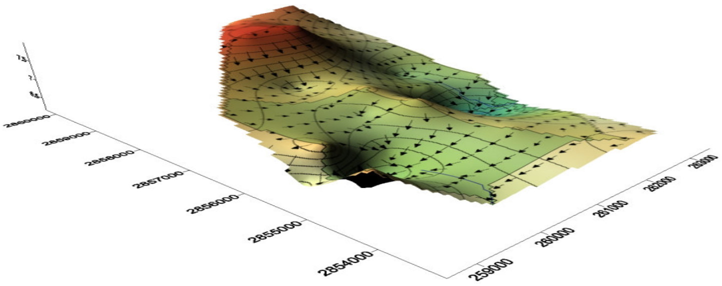
Electrical Conductivity (ECe)

Table 3 shows the soil samples which were taken at a depth of 0-20cm from different locations had an average value of EC_e of 2.04 dSm^{-1}. The EC_e values ranged 1.08 to 3 dSm^{-1}. The average values of EC_e at the given depth verify that marginal salinity was present in the soil. This may be due to the leaching of salts to the deeper layers. Kriged maps of soil salinity during the fallow period , indicated that the percentage of saline soils increased from 30 % in summer although led to conclude that increase of salinity .This result is similar to Latif and Hassan (1992) who indicated that electrical conductivity in upper layer of soil is relatively very low. According to WAPDA (1974) that soils having EC_e values less than 4 lies in the category of none saline water therefore soils of the study area can be categorized as non saline. The results of stepwise contours also revealed that ground elevation is the most important factor affecting the spatial distribution of salinity and socidity at field scale.The regression prediction models with the ground elevation alone can explain the majority of the variations of soil sailinization parameters.



Figureure 6 Overall EC flow in the Area

The SAR status of different sites at the depth of 0-20cm is shown in the Table 4.2. The average value of SAR is 9.18. The SAR ranged from 6.8 to 12.2. The ratios are less than 13 which show that concentration of Na^+ ions to that of Ca^{+2} and Mg^{+2} is low. This shows improvement in soil. Kriged maps of soil sodicity during the fallow period , indicated that the percentage of saline soils increased from 25 % in summer although led to conclude that increase of salinity .Water and Soil Investigation Division of WAPDA (1974) reported that the soils having SAR values less than 13 and ECe less than 4 lie in the category of non-sodic therefore the soils of the study area can be categorized as non sodic.



Figureure 7 Overall SAR Flow in the Area.

Residual Sodium Carbonate (RSC)

The Carbonates were absolutely absent in the soil extract and Bicarbonates were present in minute quantity and the RSC values were absolutely zero. Similar results were similar to those found by Soomro *et al.* (2013) who examined the groundwater quality in the canal command area. He also reported that the RSC content to be absent.

Table 3 Average Parameters for Soil Extract

Parameters	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
EC(dS/m)	1.12	3.25	±2.18	0.59
pH	7.3	8.7	±8.0	0.28
TDS (mg/l)	890	2235	±1562	461
SAR	7.2	12.21	±9.7	0.71

CONCLUSIONS

The average values of EC_e at the given depth verify that marginal salinity was present in the soil. This may be due to the leaching of salts to the deeper layers. The average SAR ratios are less than 13 which show that concentration of Na^+ ions to that of Ca^{+2} and Mg^{+2} is low. This shows improvement in soil. The Carbonates were absolutely absent in the soil extract and Bicarbonates were present in minute quantity and the RSC values were absolutely zero. The values of both EC and SAR were increased in summer.Ground elevation is the key factor affecting the spatial distribution of soil salinity and sodicity through change hydrological process at the field scale.

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