

Electrical Conductivity as Soil Quality Indicator of Different Agricultural Sites of Kheda District in Gujarat

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ABSTRACT: This paper presents the study and importance of electrical conductivity in agricultural soil quality management. The electrical conductivity of soil indicates the amount of salts present in the soil. Total 440 agricultural soils samples from 18 sites of Kheda district in Gujarat state were investigated. All Selected samples were collected from Government of Gujarat under soil health card programme. Agricultural soil samples were collected by authorized locally trained farmers and brought for analysis to Soil Test Laboratory. All samples analysed using standard Methods. Soil parameters, namely pH, EC, C, P and K were considered for this study. The aim of this paper is to evaluate agricultural land through electrical conductivity. Discriminate analysis is used for statistical data treatment. In present study the electrical conductivity of most of the samples (99.77%) is in salt free (0-2) range and it indicates that the study area fairly good for agriculture with respect to EC. This study also concludes that statistical analysis application can give a scientific base for agriculture soil fertility management in present tillage system.

KEYWORDS: Agricultural soil, Electrical conductivity, Soil parameter, Kheda.

I. INTRODUCTION

Agricultural soil electrical conductivity is an indirect measurement that correlates with several soils physical and chemical properties. Electrical conductivity is the ability of a material to conduct an electrical current. The electrical conductivity (EC) of soil-water mixtures indicates the amount of salts present in the soil. Salt in soil comes from the fertilizer we apply, but also from irrigation water and dissolving soil minerals. Soils contain some salts, which are essential for plant growth. However, excess salts will hinder plant growth by affecting the soil-water balance. Soils containing excess salts occur both naturally and as a result of soil use and management. Salt-affected soils are largely found in the western arid and semiarid areas of the country, where the annual rainfall is low, allowing salts to accumulate in the soil profile. The electrical conductivity measurement detects the amount of cations or anions (salts) in solution; the greater the amount of anions or cations, the greater the electrical conductivity reading.

In present tillage system soil is a basic component so that it is necessary to know and determine the needs of agricultural soil. Agriculture soil quality is that the ability of a soil to perform the functions necessary for its intended use. The quality of soil is evaluated using soil properties. Soil properties include physical and chemical properties as well as macro- micro nutrients. Soil is natural resource that provides essential nutrients to crop growth, need proper care, conservation and management in order to maintain a high degree of soil fertility system. One of the ways to assess the soil fertility status is to get soil sample tested for different soil nutrients. Statistical analysis, as powerful tools, can provide such information and assist the interpretation of soil tested data [1-4].

The objective of this work is an application of selected Descriptive statistical tool to study and analysis of soil parameters and Soil quality analysis through Electrical Conductivity

Study and analysis is applied to 440 soil samples from different sites of Kheda district [5-10].

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

II. THE STUDY AREA

The study area covers agricultural land of 18 sites of Kheda district. Kheda also known as ‘Kaira’. Kheda is located at 22.75°N 72.68°E. It has an average elevation of 21 metres (68 feet)[11]. Kheda District is sharing border with Ahmadabad District to the North , Anand District to the East , Panchmahal District to the East . Kheda District occupies an area of approximately 3943 square kilometres. This District belongs to Western India. Major soils [12] are Goradu soil (Loamy sand), Sandy soil, Black (kyari) soil , Medium Black soil, Saline alkali soil. Major field crops are rice, cotton, tobacco, maize, pearl millet and major horticultural crops are Aonla, Citrus (Lemon), papaya, guava, [13]. From the collected data at different science colleges and STL under the soil health card program by the government of Gujarat, India, we have selected 18 sites and 440 agricultural soil samples from Kheda district (Gujarat–India) for this study. Location of study area of 440 samples from 18 sites is shown in location map figure 1.

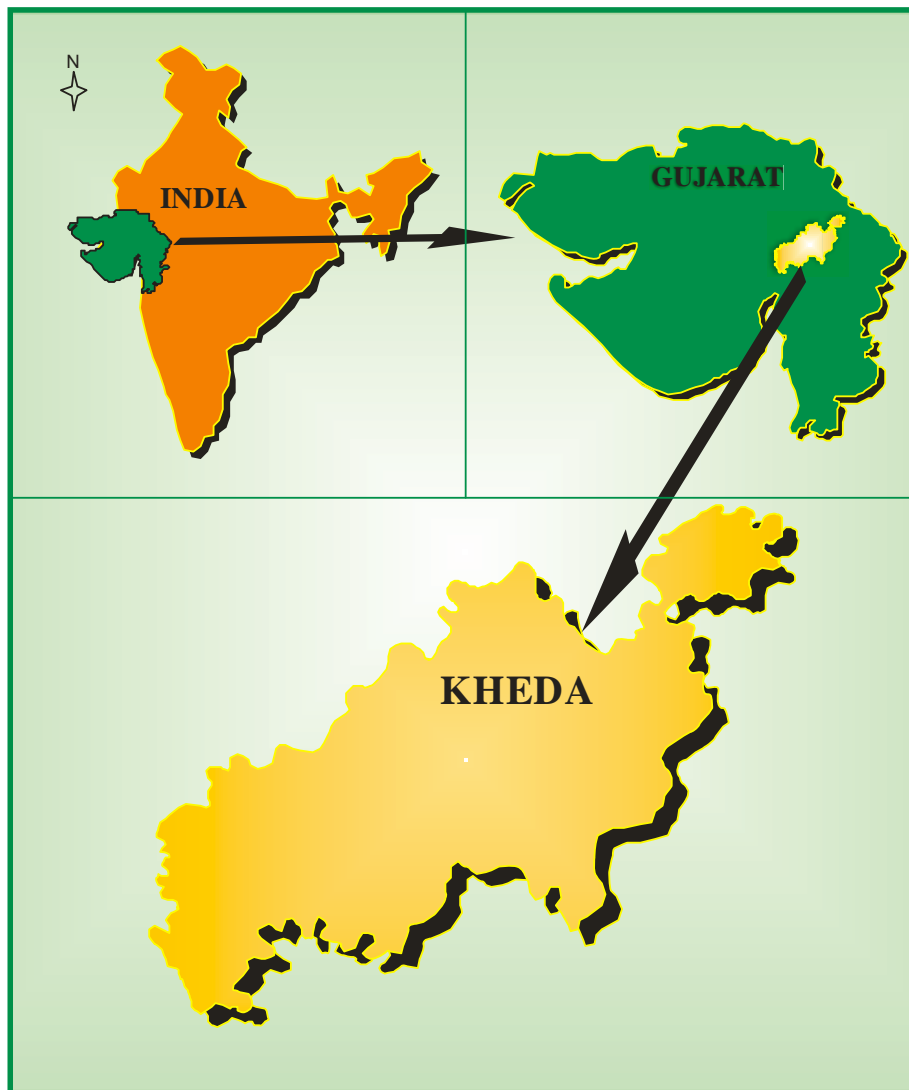


Figure 1. Location map of study area, Kheda district of Gujarat state in India

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

III. SOIL SAMPLING AND ANALYSIS

All selected samples were collected by a systematic sampling strategy at 0 to 20 cm depth below the surface. The samples were dried and passed through a 2 mm sieve to prepare them for testing. All the samples were tested using standard method [14] by following the “Methods Manual-Soil Testing in India”. The samples were analyzed [15] for physical parameters, organic carbon (OC), phosphorus (P), potassium (K), electrical conductivity (EC) and pH.

IV. TOOLS AND TECHNIQUES

Minimum, Maximum, Mean, Median, Mode, Standard deviation (SD) and variance are calculated for selected measured soil properties. Descriptive statistical analysis and Pearson’s correlation analysis are used to analyze soil samples data. Variables employed for analysis in this study include organic carbon (OC), phosphorus (P), potassium (K), electrical conductivity (EC) and pH. All statistical analysis is performed using S.P.S.S., EXCEL.

V. RESULTS AND DISCUSSION

Soil parameters (pH, EC, C, P and K) and descriptive statistics of soil analysis is shown in table 1.

Table 1. Discriptive statistics of the distribution of soil parameters

Soil parameters	Unit	Total samples N	Minimum	Maximum	Mean	Median	Mode	Standard deviation	Variance
pH		440	6.30	9.40	7.45	7.40	7.30	.48	.23
EC	dS/m	440	.10	2.27	.40	.32	.28	.26	.07
C	%	440	.25	1.80	.56	.54	.48	.17	.03
P	Kg/ha	440	7.00	88.00	41.82	39.00	36.00	16.58	274.81
K	Kg/ha	440	124.00	625.00	363.24	330.00	252.00	121.71	14812.84

Standard Soil critical limit determined by Government of india is shown in table 2, and Correlation coefficient of electrical conductivity with soil parameters is shown in table 3.

Table 2. Soil Critical Limits for Electrical Conductivity (Followed by MMSOIL-Gov. of India-2011)

Parameter	Unit	Range	Interpretation
EC	dS/m	0 - 2	Salt Free
		4 - 8	Slightly Saline
		8 - 15	Moderately Saline
		> 15	Highly Saline

Table 3. Correlation coefficients of Electrical conductivity and micronutrients

Soil Properties	Correlation Coefficient (r)
EC - pH	0.115
EC - OC	0.236
EC - P	0.040
EC - K	0.344

Considering Standard Soil critical limit from table 2, here EC divided in to four categories like salt free slightly saline, moderately saline, highly saline is shown in table 4.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 8, August 2015

Table 4 : Electrical Conductivity in the agricultural soil of Kheda District in gujarat

Site Code	Site Name	Total Samples	Electrical Conductivity in Samples			
			Salt Free	Slightly Saline	Moderately Saline	Highly Saline
1	Anara	40	40	0	0	0
2	Alina	33	33	0	0	0
3	Antisar	37	37	0	0	0
4	Undhela	18	18	0	0	0
5	Khuntaj	27	27	0	0	0
6	Chalali	18	18	0	0	0
7	Dantali	25	25	0	0	0
8	Navagam	16	16	0	0	0
9	Nayaka	33	33	0	0	0
10	Palana	36	36	0	0	0
11	Limbasi	22	22	0	0	0
12	Vadtal	18	18	0	0	0
13	Vanoda	17	17	0	0	0
14	Vadad	19	19	0	0	0
15	Sarasvani	17	17	0	0	0
16	Sarali	22	22	0	0	0
17	Sinhuj	22	22	0	0	0
18	Hathaj	20	19	1	0	0

All study sites and its EC status presenting in graphical form in figure.2, only one sample fall in (>2) slightly saline category. Here statistically it may considered as outlier.

Statistical analysis of soil samples shows Electrical conductivity (EC) is varied from 0.1 to 2.27 dSm⁻¹ with a mean value of 0.4 dSm⁻¹ and median 0.32 dSm⁻¹ and mode 0.28 dSm⁻¹. Here, most of the samples (99.77%) are salt free i.e. values are between 0 - 2 (ref: table 2 and 4). Here one sample shows the EC value >2.

Correlation of EC With pH, OC, P and K: Correlation coefficient (r) is given in table-3.

Correlation studies of EC with pH, OC, P and K shows positive relationship with r value 0.115, 0.236, 0.040 and 0.344 respectively. Similar study about relationship among pH, EC and soil parameters were also reported [6].

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

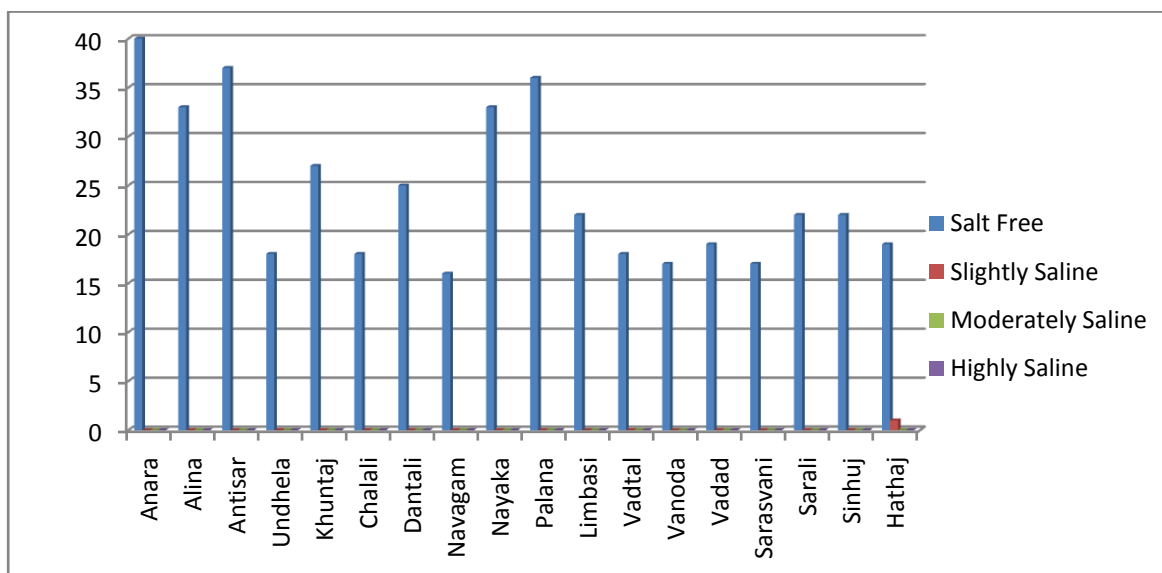


Figure 2. Graph of EC status in present study area..

VI. CONCLUSION

- Present Study shows that the study area is free from salt as well as pH and Electrical conductivity of study area are fairly good for agriculture.
- This study concludes that correlation analysis can provide a scientific basis for managing agricultural soil health.
- Observation shows positive significant correlation of EC with pH, OC, Potassium and Phosphorus.

ACKNOWLEDGEMENTS

The author is thankful to Dr. H. M. Babariya, Deputy Director of Agriculture Soil Test Laboratory, Department of Agriculture, Gandhinagar, Gujarat, India for providing soil test data for the purpose of this study.

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ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

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