

SOIL STUDY BASED ON ELECTRICAL CONDUCTIVITY OF AGRICULTURAL LAND OF TAPI DISTRICT IN GUJARAT

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ABSTRACT

Agriculture soils 800 samples (0-20cm) representing 32 villages of Tapi district in Gujarat state were investigated. Selected samples were collected from Government of Gujarat under soil health card programme. Soil samples were collected by authorized locally trained farmers and brought for analysis to Soil Test Laboratory. Standard Methods were applied for the soil analysis. Soil parameters, namely pH, EC, C, P and K were considered for study. The aim of this study is to evaluate agricultural land through electrical conductivity and their correlation ship. Discriminate analysis and Correlation analysis are used for statistical data treatment. In present study the electrical conductivity of all samples (100%) is in salt free (0-2) range and it indicates that the study area fairly fit for agriculture. For the present tillage system this paper concludes that the application of statistical treatment can give a scientific stand for agriculture soil fertility management.

KEYWORDS: Electrical Conductivity, Salt Free, Soil Fertility, Soil Parameter, Tapi

INTRODUCTION

Soil is a medium for growing plants. Soil is a naturally occurring porous medium that supports the growth of plant and roots by retaining air, heat, water and nutrients that provides mechanical support to the plant. Soil is a basic component for modern agricultural system so that it is necessary to know the basic needs of soil. Agriculture soil quality is that the ability of a soil to perform the functions necessary for its intended use. Soil health depends on the combined effects of three major interacting components. These are the chemical, physical and biological characteristics of the soil. The health quality of soil is evaluated using soil properties. Soil properties include physical and chemical properties. 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 chemical parameters, physical parameters and nutrients.

The Objectives of this Study are

- To study and determine the relationship between EC with pH and macro nutrients (P, K and C) using descriptive statistical analysis.
- To determine soil quality based on electrical conductivity.

Discriminate analysis and Pearson's correlation analysis were applied to 800 soil samples from different 32 agricultural sites (25 samples from each site) of Tapi district in Gujarat [1-8].

MATERIALS AND METHODS

The Study Area

The study area is agricultural Soil of different places of Tapi district. In year 2007, Tapi District was formed out of some Talukas separated from erstwhile Surat District. Vyara is head quarter of Tapi District, which comprises five Talukas – Vyara, Songadh, Valod, Uchhal and Nizar. Vyara and Songadh in Tapi district are known for dense forests with a major production of bamboos. The district shares border with Maharashtra. Tapi district is one of the 26 districts of Gujarat state in India.[9] Tapi district covers an area of 3434.64 Sq Km. It is located 73.5degree to 74.23 degree East (Longitude) 21.0 degree to 21.23 degree North (Latitude). The district receives an average rainfall of 1926 mm. maximum temperature raises upto 45 degree Centigrade. Tapi district is bordered by four rivers, Tapi, Midoda, Purna and Ambika.

Total geographical area is 345000 ha. The study area is however, restricted to the agricultural activities that cover an area of 164100 ha. Major soils[10] are heavy black and sandy type. Major field crops[11] are Paddy, Sorghum, Sugarcane, groundnut, cotton, and major horticultural crops are mango, sapota, papaya, banana and hostricultural crops-vegetable Okra, Brinjal, Onion, Chili, Tomato.

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 800 soil samples from different 32 sites of Tapi district (Gujarat–India) for this study.

Total numbers of soils samples, names of sample site and EC status are shown in table 4. Location of study area of 42 samples is shown in location map figure 1.

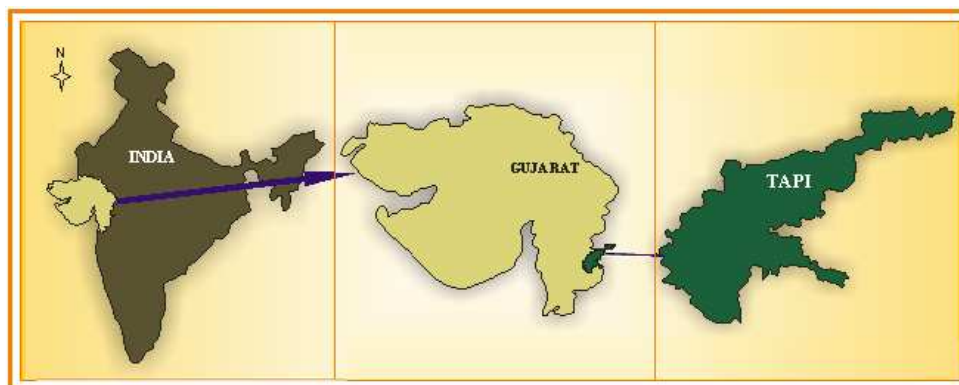


Figure 1: Location Map, Tapi District in Gujarat, India

Soil Sampling and Analysis: Soil 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 [12] by following the “Methods Manual-Soil Testing in India”. The samples were analyzed [13] for physical parameters, organic carbon (OC), phosphorus (P), potassium (K), electrical conductivity (EC) and pH.

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.

RESULTS AND DISCUSSION

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

Table 1: Descriptive Statistics of the Distribution of Soil Parameters (MED= Median, SD= Standard Deviation, VAR= Variance)

Soil Parameters	Unit	Total Samples	Minimum	Maximum	Mean	MED	Mode	SD	VAR
pH		800	6.08	7.8	7.16	7.2	7.2	0.22	0.05
EC	dS/m	800	0.2	0.95	0.38	0.37	0.39	0.08	0.01
C	%	800	0.04	0.99	0.51	0.46	0.42	0.12	0.01
P	Kg/ha	800	12	92	35.66	35	32	13.5	182.38
K	Kg/ha	800	104	766	403.94	401	369	35.81	1282.03

Table 2: Critical Limit of Soil Parameters (Followd by MMSOIL-Gov. of India-2011)

Parameters	Interpretation	
pH	< 4.6	Extremely acidic
	4.6 - 5.5	Strongly acidic
	5.6 - 6.5	Moderately acidic
	6.6 - 6.9	Slightly acidic
	7	Neutral
	7.1 - 8.5	Moderately alkaline
	>8.5	Strongly alkaline
EC dS/m	0 - 2	Salt Free
	4 - 8	Slightly Saline
	8 - 15	Moderately Saline
	> 15	Highly Saline
OC %	<0.5	Low
	0.5- 0.75	Medium
	> 0.75	High
P Kg/ha	< 10.0	Low
	10 - 24.6	Medium
	> 24.6	High
K Kg/ha	< 108	Low
	108- 280	Medium
	> 280	High

Table 3: Correlation Coefficients

Soil Properties	Correlation Coefficient (r)
EC -pH	0.08
EC - OC	0.0662
EC - P	0.0357
EC - K	0.018

Table 4: Electrical Conductivity in the Agriculture Soil of Tapi District in Gujarat

Village Code	Name of Village	TS	Electrical Conductivity in Samples			
			SF	SS	MS	HS
1	Andhatri	32	32	0	0	0
2	Andharvadi dur	32	32	0	0	0
3	Amonia	32	32	0	0	0
4	Ota	32	32	0	0	0
5	Kapura	32	32	0	0	0
6	Karanjkhed	32	32	0	0	0
7	Karanjvel	32	32	0	0	0
8	Kakdava	32	32	0	0	0
9	Kelkui	32	32	0	0	0
10	Kohli	32	32	0	0	0
11	Khuntadiya	32	32	0	0	0
12	Garvan	32	32	0	0	0
13	Gheriyavav	32	32	0	0	0
14	Chikhhalda	32	32	0	0	0
15	Chhindiya	32	32	0	0	0
16	Dhamodla	32	32	0	0	0
17	Padamdungari	32	32	0	0	0
18	Paniyari	32	32	0	0	0
19	Pathakvas	32	32	0	0	0
20	Pisavara	32	32	0	0	0
21	Balda	32	32	0	0	0
22	Bhojpur dur	32	32	0	0	0
23	Musa	32	32	0	0	0
24	Rampura dur	32	32	0	0	0
25	Lotarava	32	32	0	0	0
26	Vankla	32	32	0	0	0
27	Vanskui	32	32	0	0	0
28	Virpor	32	32	0	0	0
29	Veghla	32	32	0	0	0
30	Vyara	32	32	0	0	0
31	Sadagvan	32	32	0	0	0
32	Saraiya	32	32	0	0	0

TS = Total Samples, SF = Salt free, SS = Slightly saline, MS = Moderately saline, HS = Highly saline

Chemical analysis of soil samples shows pH range maximum (7.8) and Minimum (6.08). Soils are moderately acidic to moderately alkaline in reaction, pH varied from 6.08 to 7.8 with the mean value of 7.16, median and mode of 7.2, Standard deviation (SD) and variance are 0.22 and 0.05 respectively. Electrical conductivity (EC) is varied from 0.2 to 0.95 dSm^{-1} with a mean value of 0.38 dSm^{-1} and median 0.37 dSm^{-1} and mode 0.39 dSm^{-1} . Here, all samples (100%) are salt free i.e. values are between 0 - 2 (ref: table 2 and 4). Organic carbon (OC) of the soil is varied from 0.04 – 0.99 % with a mean value of 0.51 %, median of 0.46, mode of 0.42, Standard deviation (SD) of 0.12 and variance of 0.01 given in table 1. Phosphorus content of studied samples range is 12 to 92 with mean and median value 35.66 and 35 kg/ha. Potassium (K) range 104-766 kg/ha with mean 403.94 kg/ha and it shows high value in study area. High Phosphorous (P), Potassium (K) and sulfur(S) values shows intensive fertilizer practice in present tillage system.

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 Less positive relationship with r value 0.08, 0.0662,

0.0357 and 0.018 respectively.

Similar study about relationship among pH, EC and soil parameters were also reported [2].

CONCLUSIONS

- Observation shows positive significant correlation of EC with pH, OC, P, and K.
- Based on electrical conductivity the study area posses fairly good agricultural land.
- Present Study shows that the agricultural land of this study area is free from salt.
- Intensive agriculture practices reflect in very high value of Sulfur.
- This study concludes that statistical methods like discriminate analysis and Correlation analysis can provide a scientific basis for monitoring agriculture soil fertility management.

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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