

# Correlation Study of Soil Parameters of Kutch district Agriculture Land

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**Abstract-** Correlation analysis is used for the study of chemical parameters of agricultural soil of different villages of Kutch district of Gujarat state in Western India. Our primary focus is to study mung bean crop based on randomly selected 30 medium black soil samples. Under the Soil Health Card Program of Government of Gujarat, soil samples were collected by authorized locally trained farmers and brought for analysis to Soil Test Laboratory, Bhuj. Standard Methods were used for the soil quality analysis. The objective of this work is to study and evaluate relation between soil properties and macro-nutrients (P, K, C and S) by using correlation analysis. Present study concludes that the statistical method 'correlation analysis' can provide a scientific basis for controlling and monitoring the agriculture soil fertility management.

**Index Terms-** Fertility management, Kutch, correlation analysis, soil health

## I. INTRODUCTION

In the age of modern and scientific tillage, it is necessary to know the basic needs of soil. Soil is a naturally occurring porous medium that supports the growth of plant roots by retaining air, heat, water and nutrients; and provides mechanical support to the plant. Soil provides a reservoir of nutrients required by crops, but not necessarily at optimum levels of immediate availability to plants. The purpose of soil analysis is to assess the adequacy, surplus or deficiency of available nutrients for crop growth and to monitor change brought about by farming practices. Growth of plant is determined through soil fertility and soil fertility is determined by the availability of macro and micronutrients.

The purpose of this paper is:

- to study classification of soil samples according to their properties by using descriptive statistical analysis.
- to determine the relationship between pH, EC and macro nutrients (P, K, C and S).

In this work, Pearson's correlation analysis is used to study 30 random, medium black soil samples collected from different agricultural areas of Kutch<sup>1-5</sup>.

## II. MATERIALS AND METHODS

**The study area:** The study area is agricultural land of different villages of different tehsil of Kutch district. Kutch is a district of Gujarat state in Western India, covering an area of 45,652 km<sup>2</sup>.<sup>6</sup> It is one of the largest district in India, located between 22.44° to 24.41° North (latitude) and 78.89° to 71.45° East (longitude). The temperature range is 45°C (max.) and 4°C (min.). Average rainfall is 587 mm. Kutch is virtually an island, as it is surrounded by the Arabian Sea in the west, by the Gulf of Kutch in south and southeast and by Rann of Kutch in north and northeast. The border with Pakistan lies along the northern edge of the Rann of Kutch.

Total geographical area is 1958000 ha. The study area is however, restricted to the agricultural activities that cover an area of 680000 ha. Major soils<sup>7</sup> are medium black, sandy and hydromorphic type. Major field crops are bajra, green gram, castor, groundnut, cotton, wheat, moth bean and major horticultural crops are mango, sapota, papaya, banana, cucurbits.<sup>8</sup> 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 30 medium black soil samples based on mung crop from different regions of Kutch district (Gujarat-India) for present study.

Numbers of soils samples, names of villages and respective tehsils are shown in table 1. Location of study area and village code of 30 samples is shown in location map figure 1.

**Soil sampling and analysis:** Soil samples were sampled 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<sup>9</sup> by following the "Methods Manual-Soil Testing in India". The samples were analyzed for physical parameters, organic carbon (OC), phosphorus (P), potassium (K), electrical conductivity (EC) and pH.

**Tools and techniques:** Mean, minimum, maximum and standard deviation (SD) are calculated for measured soil parameters. 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 are performed using MATLAB, EXCEL.

Table 1: Soil samples identification

Sample no. on the map	Name of village	Name of tehsil	Sample no. on the map	Name of village	Name of tehsil
1	Nagiyari	Bhuj	16	Bhadiyamoti	Mandvi
2	Jamthada	Mandvi	17	Jamthada	Mandvi
3	Rayghanapar	Bhuj	18	Vingadiya	Mandvi
4	Ghandhigram	Mandvi	19	Vingadiya	Mandvi
5	Nagiyari	Bhuj	20	Bhadiyamoti	Mandvi
6	Nagiyari	Bhuj	21	Ghandhigram	Mandvi
7	Rajda	Mandvi	22	Ghandhigram	Mandvi
8	Fulra	Bhuj	23	Rajda	Mandvi
9	Ghandhigram	Mandvi	24	Rajda	Mandvi
10	Shekhadiya	Mundra	25	Anandsar	Bhuj
11	Jamthada	Mandvi	26	Rajda	Mandvi
12	Rajda	Mandvi	27	Rajda	Mandvi
13	Bhadiyamoti	Mandvi	28	Rajda	Mandvi
14	Fulra	Bhuj	29	Rajda	Mandvi
15	Rayghanapar	Bhuj	30	Rajda	Mandvi

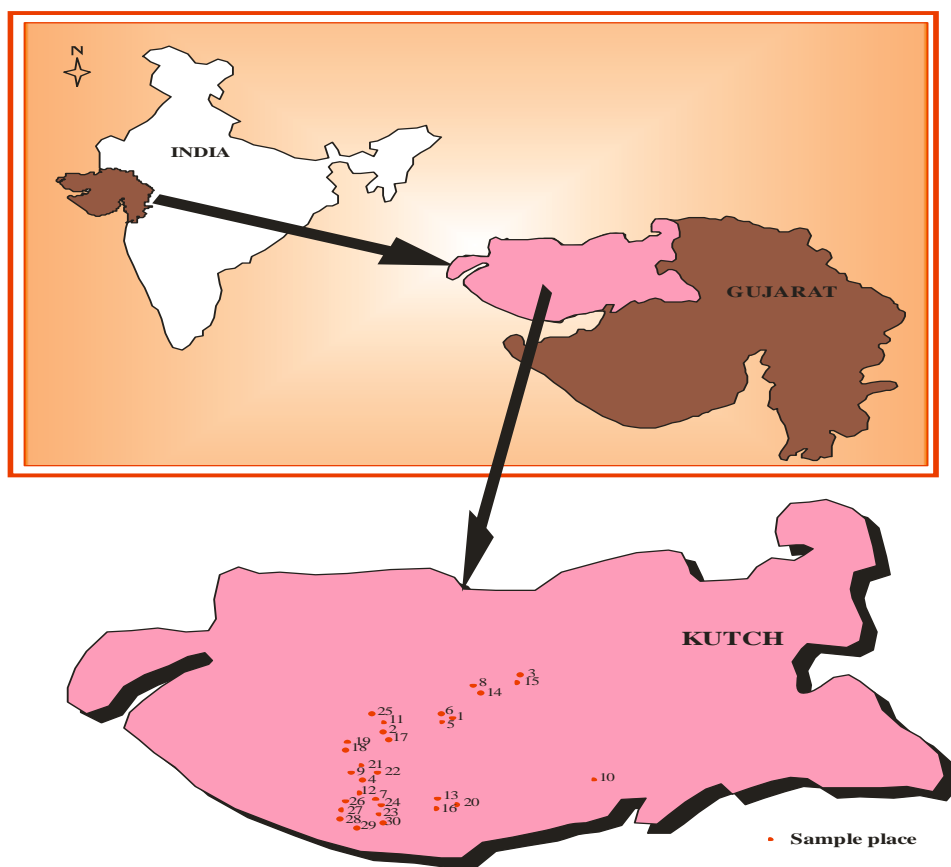


Figure 1: Location map of study area, Kutch district, Gujarat, India.

Table 2: Soil characteristics of selected samples from the study area

Sample No.	pH	EC	C	P	K	S	Sample No.	pH	EC	C	P	K	S
1	7.9	0.65	0.63	46	244	34.72	18	7.3	0.23	0.36	26	258	42
2	6.9	0.22	0.44	44	265	37.2	19	7.6	0.36	0.54	23	239	34.72
3	7.8	0.19	0.47	47	232	35	20	6.8	0.22	0.65	44	164	35
4	8.8	0.12	0.54	25	147	42.16	21	8.2	0.2	0.63	54	254	24.8
5	7.5	0.7	0.47	36	256	32.24	22	7	0.21	0.58	25	585	32.24
6	7.1	0.74	0.45	21	248	42.16	23	8.1	0.25	0.96	36	952	34.72
7	7.2	0.52	0.55	88	214	45	24	8.9	0.26	0.63	54	654	41
8	7.2	0.37	0.35	21	288	27.28	25	7.7	0.54	0.5	32	296	25
9	8.5	0.63	0.84	25	254	29.76	26	9.6	0.23	0.63	58	555	39.68
10	7.51	0.27	0.76	47	300	22.32	27	7.8	0.23	0.96	58	987	39.68
11	7.4	0.17	0.68	59	235	37.2	28	6.6	0.36	0.69	85	258	32.24
12	7.4	0.25	0.31	32	263	42.16	29	9.8	0.63	0.63	45	789	32
13	6.9	0.23	0.58	70	291	27.28	30	8.9	0.63	0.65	84	753	44.64
14	7.6	0.5	0.81	36	268	34.72	Mean	7.71	0.36	0.59	46.40	368.63	35.29
15	7.12	0.43	0.62	47	328	44.64	Minimum	6.60	0.12	0.22	21.00	147.00	22.32
16	7.1	0.19	0.22	67	234	25	Maximum	9.80	0.74	0.96	88.00	987.00	45.00
17	7.13	0.18	0.57	57	248	42	Standard Deviation	0.82	0.19	0.17	19.17	231.99	6.61

### III. RESULTS AND DISCUSSION

Soil parameters and descriptive statistics of soil analysis is shown in table 2. Statistical analysis is done using Pearson correlation method. Chemical analysis of collected soil samples shows pH range between 9.8 and 6.6. Soils are neutral to alkaline in reaction, pH varied from 6.6 to 9.8 with the mean value of 7.71. As presented in table-2 and table 3, (6.6 - 9.8) pH value indicates, 16% of samples are alkaline and 84% samples are neutral. No sample is acidic i.e. pH < 6.5. Electrical conductivity (EC) is varied from 0.12 to 0.74 dScm<sup>-1</sup> with a mean value of 0.36 dScm<sup>-1</sup>. It shows all samples are salt free i.e. values are between 0 - 2 (ref: table 3). Organic carbon (OC) of the soil is varied from 0.22 – 0.96 with a mean value of 0.59 given in table-1. It is very low i.e. < 0.50 in 26% soil samples, medium i.e. 0.50-0.75 in 58% soil samples and 16% samples are with high value i.e. > 0.75. Phosphorus content of studied samples is 21–88 kg/ha given in table-2.

It is observed content of phosphorous in 94% samples are of high range i.e. > 24.6, one sample is in medium range and one is in lower range. It can be attributed to high fertilizer practice. In case of potassium no sample is in low range, either they are in medium or in high range. Among 30 samples, 60% contains medium amount i.e. between 108 - 280 whereas remaining 40% are with very high amount i.e. > 280, may be due to use of over fertilizers.

#### Relation among EC, pH and Macronutrients

Correlation matrix is given in figure 2 and table-4. Correlation studies of pH with EC, potassium and organic

carbon shows strong relationship with r = 0.170, r = 0.499 and r = 0.285 respectively, where as positive but not very significant correlation with sulfur (r = 0.114). Less negative correlation of EC is found with phosphorus (r = -0.082), while positive but not significant correlation with organic carbon (r = 0.062), potassium (r = 0.024) and sulfur (r = 0.032). EC is positive but not significant with carbon (r = 0.115) and sulfur (r = 0.112). Organic carbon is highly correlated with potassium (r = 0.529) where as it is less positively correlated with phosphorus (r = 0.156). Similar results were reported by Chauhan<sup>11</sup> and R.P.Singh<sup>12</sup>.

### IV. CONCLUSION

Following conclusions from this study can be made for the medium black soil of KUTCH district in Gujarat state.

1. Observation shows positive significant correlation of pH with available macronutrients organic carbon and potassium.
2. Electrical conductivity has positive but not significant correlation with organic carbon, sulfur and potassium, while it has poor negative correlation with phosphorus.
3. Organic carbon has high degree of positive correlation with potassium.

4. Electrical conductivity and pH inversely correlate with phosphorus.

Table 3: General interpretation of soil properties (followed 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
EC dS/cm	>8.5	Strongly alkaline
	0 - 2	Salt Free
	4 - 8	Slightly Saline
	8 - 15	Moderately Saline
OC %	> 15	Highly Saline
	<0.5	Low
	0.5 - 0.75	Medium
P Kg/ha	> 0.75	High
	< 10.0	Low
	10 - 24.6	Medium
K Kg/ha	> 24.6	High
	< 108	Low
	108 - 280	Medium
S	> 280	High
	8 - 10	Critical limit (ppm)

5. Study shows that the study area is free from salt, not even acidic in nature. It is moderately neutral in nature.

6. Very high value of potassium indicates use of intensive agriculture practices.

7. EC and pH of study area are fairly good for agriculture.

8. Present study concludes that statistical methods e.g. correlation analysis can provide a scientific basis for controlling and monitoring agriculture soil fertility management.

Table 4: Matrix correlations among soil characteristics in tabular form

Soil parameters	pH	EC	C	P	K	S
pH	1.000					
EC	0.170	1.000				
C	0.285	0.062	1.000			
P	-0.014	-0.082	0.156	1.000		
K	0.499	0.024	0.529	0.144	1.000	
S	0.114	0.032	-0.005	0.117	0.147	1.000

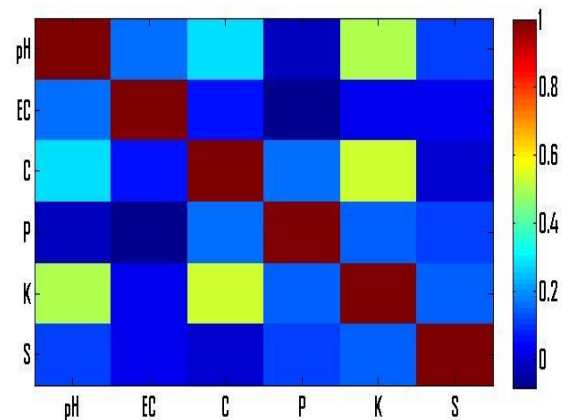


Figure 2: Correlations matrix of soil characteristics.

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