

# THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

## Soil Study through Correlation Analysis of Chemical Parameters of Agricultural Land from Kheda District in Gujarat

**Atulkumar H. Patel**

Associate Professor & I/C Principal,  
Kamani Science College & Prataprai Arts College, Amreli - Gujarat, India

### **Abstract:**

*Discriminant and Correlation analysis were used for the evaluation of agricultural soil through chemical parameters of soil from different villages of Kheda district of Gujarat state in India. Our primary focus is to study on randomly selected 51 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,. Standard Methods were used for the soil quality analysis. The aim of this paper is to study and evaluate relation between soil properties and macro-nutrients ( Phosphorous, Potassium and Organic carbon ) by using Pearson's correlation analysis. Present paper concludes that the statistical method 'correlation analysis' can give a scientific basis for managing the agriculture soil fertility.*

**Keywords:** Correlation, Kheda, Micronutrients, Soil fertility

### **1. Introduction**

In the modern and scientific agricultural system soil is a basic component so that it is necessary to determine the needs of soil. Agricultural 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 includes physical and chemical properties as well as macro- micro nutrients. Soil is a natural resource that provides essential nutrients to crope 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 a soil sample tested for different soil nutrients. Statistical analysis, as a powerful tools, can provide such information and assist the interpretation of soil tested data [1-2].

The objective of this work is:

- An application of selected Descriptive statistical tool to study and analysis of soil parameters.
- Soil quality analysis through correlation analysis

Pearson's correlation is applied to 51 soil samples from different sites of Kheda district [3-8].

### **2. Material and Methods**

#### *2.1 The Study Area*

The study area covers agricultural land of 51 villages 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)[9]. 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 [10] 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, [11].

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 51 agricultural soil samples from different sites of Kheda district (Gujarat-India) for present study.

Samples numbers, names of site and Concentration of soil properties shown in table 1. Location of study area shown in location map figure 1.

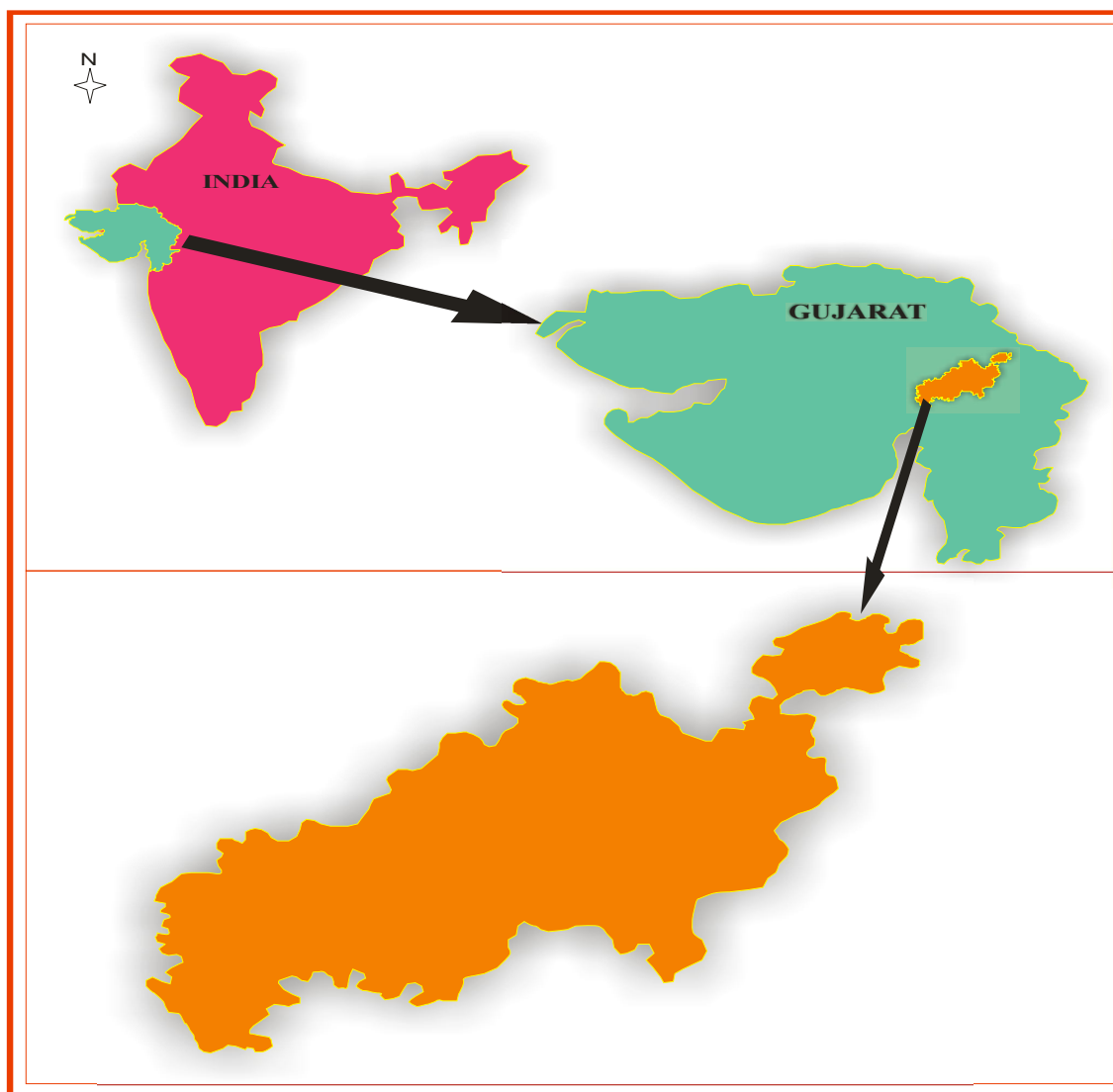


Figure 1: Location map of study area, KHEDA district of Gujarat, India.

## 2.2. Soil sampling and Analysis

All the Soil samples were managed by a systematic sampling strategy at 0 to 20 cm depth below the soil surface. The samples were dried and passed through a 2 mm sieve to prepare them for testing. All the samples were tested using a standard method by following the “Methods Manual-Soil Testing in India”[12]. All the samples were tested and analyzed for soil properties like pH, electrical conductivity (EC), phosphorus (P), potassium (K) and Organic carbon (OC)

## 2.3. Tools and Techniques

Minimum, maximum, mean, 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 pH, organic carbon (OC), phosphorus (P), potassium (K), electrical conductivity (EC). Using EXCEL and S.P.S.S. all statistical analysis are performed.

## 3. Results and Discussion

Soil parameters (pH, EC, P, K and OC ) and descriptive statistics of soil analysis is shown in table 1. Statistical analysis is done using Pearson correlation method. Chemical analysis of collected soil samples shows pH range maximum (8.0) and Minimum (6.2). Soils are Slightly acidic to moderately alkaline in reaction, pH varied from 6.2 to 8.0 with the mean value of 7.35 SD of 0.45. Electrical conductivity (EC) is varied from 0.10 to 0.98  $\text{dSm}^{-1}$  with a mean value of 0.37  $\text{dSm}^{-1}$  and SD of 0.19. All samples (100%) are salt free i.e. values are between 0 - 2 (ref: table 1 and 2). Organic carbon (OC) of the soil is varied from 0.25 – 1.80 % with a mean value of 0.61 % and SD of 0.26 given in table-1. Phosphorus content of studied samples is 18 to 88 kg/ha with mean value 43.18 and SD value 17.69. Potassium (K) range 199-713 kg/ha with mean 358.43 and SD of 101.99, it shows high value in study area. High value of Phosphorous (P), Potassium (K) and sulfur(S) values shows over fertilizer practice in soil.

Patrak No.	Sample site	pH	EC	C	P	K
6986864	Akalacha	7.6	0.41	1.8	70	713
6578767	Anara	7.3	0.25	0.31	57	385
7150325	Aboch	6.9	0.56	1.23	63	399
6989721	Amrapur	7.4	0.34	0.43	60	283
6638797	Alina	6.5	0.25	0.46	56	262
7231796	Asamali	7.9	0.29	1.22	50	395
6849846	Asapur	7.7	0.27	0.69	26	258
7232683	Kanera	7	0.8	0.93	36	415
7146848	Karanpur	6.4	0.38	0.25	88	199
6985939	Karoli	7.1	0.34	0.68	20	359
6852964	Kathadi	7.5	0.25	0.72	23	493
7145715	Kunjara	6.4	0.39	0.53	27	472
6721218	Kothipur	7.9	0.55	0.72	67	315
7151182	Khanpur	6.2	0.27	0.63	41	514
6633618	Khuntaj	7.7	0.39	0.48	37	315
6635679	Khuntaj	7.7	0.43	0.37	26	224
7151301	Ghadiya	7.3	0.98	0.63	83	456
6277129	Javol	7	0.23	0.4	54	395
6992556	Jinjar	7.5	0.4	0.42	22	279
6856125	Jesapura-mithapura	7.4	0.46	0.45	56	416
6637651	Toraniya	7.9	0.39	0.39	26	256
6637816	Davapura	7.5	0.19	0.49	35	324
6273782	Dantali	6.9	0.18	0.67	72	386
6273500	Davda	7.8	0.21	0.59	28	420
7154784	Dasalvada	6.9	0.71	0.64	77	451
6562365	Danpat	7.8	0.54	0.39	24	282
7231725	Nadhanpur	7.8	0.27	0.39	38	250
6272428	Navagam	6.7	0.24	0.49	20	301
7238835	Nayaka	7.5	0.62	0.58	41	590
7238526	Nandoli	8	0.21	0.42	43	295
6273750	Palana	6.9	0.28	0.69	46	343
7239155	Pipariya	7.4	0.26	0.54	50	370
6277775	Piptala	6.8	0.1	0.66	26	219
7234736	Porada	6.9	0.27	0.54	60	275
6559733	Felsani	7.5	0.26	0.42	39	429
6561063	Bagdol	7.5	0.87	0.52	57	294
6559997	Baliyadev	6.9	0.41	0.52	46	320
6863558	Bhadrasa	7.9	0.24	0.63	59	267
6852084	Bhatpur	7.4	0.2	0.82	23	289
7134922	Bhungaliya	8	0.62	0.63	41	393
7232010	Bhairai	7.4	0.64	0.53	34	600
6471255	Malavada	7.4	0.13	0.32	48	228
6562052	Meghaliya	7.3	0.41	0.6	34	363
6634144	Moti Khadol	7.7	0.27	0.32	18	358
6720865	Modaj	7.3	0.45	0.8	47	407
6716629	Modaj	7.3	0.29	0.78	41	373
6473467	Ratanpur	7.7	0.4	0.5	28	367
6720122	Rundan	7.8	0.29	0.92	23	315
6558923	Ladvel	7.9	0.34	0.47	57	324
6275796	Vadtal	7.4	0.23	0.69	31	305
6853984	Vasad	7.3	0.28	0.76	28	339
<b>Mean</b>		<b>7.35</b>	<b>0.37</b>	<b>0.61</b>	<b>43.18</b>	<b>358.43</b>
<b>Minimum</b>		<b>6.20</b>	<b>0.10</b>	<b>0.25</b>	<b>18.00</b>	<b>199.00</b>
<b>Maximum</b>		<b>8.00</b>	<b>0.98</b>	<b>1.80</b>	<b>88.00</b>	<b>713.00</b>
<b>Standard Deviation</b>		<b>0.45</b>	<b>0.19</b>	<b>0.26</b>	<b>17.69</b>	<b>101.99</b>

Table 1: Concentration of soil properties of selected samples from the study area

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 2: Interpretation of soil properties (Reference: MMSOIL-Gov. of India-2011)

Parameter	Description
pH	pH value of Agriculture Soil
EC	Electrical Conductivity, decisiemen per meter
C	Organic carbon, %
P	Phosphorous, Kg/ha
K	Potassium, Kg/ha

Table 3: Discription of soil properties

Soil parameter	Ph	EC	C	P	K
pH	1				
EC	.047	1			
C	.035	.126	1		
P	-.221	.311	.134	1	
K	-.080	.333	.498	.132	1

Table 4: Correlations Matrix between soil characteristics

### 3.1. Relation among EC, pH and Macronutrients:

Correlation matrix in table form is given in table-4. Correlation studies of EC with phosphorus and potassium shows strong relationship with  $r = 0.311$  and  $r = 0.333$  respectively, whereas less positive correlation with OC ( $r = 0.126$ ). Less negative correlation of pH is found with potassium ( $r = -0.080$ ) and phosphorus ( $r = -0.221$ ), while positive, but not a significant correlation with organic carbon ( $r = 0.035$ ). Organic carbon is strong positively correlated with potassium ( $r = 0.498$ ) whereas it is poor positively correlated with phosphorus ( $r = 0.134$ ).

## 4. Conclusion

1. Observation shows positive significant correlation of EC with Potassium.
2. Electrical conductivity has positive but not significant correlation with phosphorus and OC.
3. Organic carbon has a high degree of positive correlation with potassium.
4. Present Study shows that the study area is free from salt.
5. Very high value of OC, P and K indicates use of intensive agriculture practices.
6. pH and Electrical conductivity of study area are fairly good for agriculture.
7. Present study concludes that correlation analysis can provide a scientific basis for managing agricultural soil health.

### 4.1. 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.

## 5. References

- i. Sena, M.M., R.T.S. Frighetto, P.J. Valarini, H. Tokeshi and R.J. Poppi, 2002. Discrimination of management effects on soil parameters by using principal component analysis: A multivariate analysis case study. *Soil and Tillage Research*, 67: 171-181.
- ii. Einax, J.W. and U. Soldt, 1999. Geostatistical and multivariate statistical method for the assessment of polluted soils; Merits and limitations. *Chemometrics Intell. Lab.*, 46: 79-91.
- iii. Patel Prakash L., Patel Nirmal P., Patel Prakash H. and Gharekhan Anita. Correlation study of Soil Parameter of Kutch district Agriculture land. *International Journal of Scientific and Research Publications* 2014, Volume-IV, Issue-V, p2989.
- iv. Vijayakumar R, Arokiaraj A, Martin DP. Micronutrients and their Relationship with Soil Properties of Natural Disaster Prone Coastal Soils. *Res J Chem Sci*. 2011;1(1):8-12
- v. Mico C, Recatala L, Peris M, Sanchez J. Assessing heavy metal sources in agricultural soil of an European Mediterranean area by multivariate analysis. *Chemosphere* 2006;65:863-72
- vi. Mali VS, Zende NA, Verma UK. Correlation between soil physico-chemical properties and available micronutrients in salt affected soils, 17th WCSS 2002; Thailand
- vii. Patel Prakash L., Patel Prakash H., Patel Nirmal P. and Gharekhan Anita. "Agricultural Soil Study through Electrical Conductivity and their Relationship with Micronutrients of Bhuj Region in Kutch District" *International Journal of Science and Technoledge*, Volume 2, Issue 5, May 2014, p: 88-92
- viii. Patel Atulkumar H. "Correlation analysis of Agricultural Soil Parameters of Tapi District in Gujarat," *International Journal of Science and Research IJSR* , Volume 4, Issue 7, July 2015, p:1994-1997.
- ix. <http://en.wikipedia.org/wiki/Kheda>
- x. Soils of Gujarat - <http://goo.gl/CF9Rb>
- xi. Agriculture Contingency Plan for District, Kheda, Gujarat
- xii. "Methods Manual-Soil Testing in India", Department of Agriculture & Cooperation Ministry of Agriculture Government of India 2011.