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Correlation Study of Agricultural Soil Parameters of Tapi District in Gujarat

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Abstract: ***In this paper, Correlation analysis is used for the study of soil chemical parameters of agricultural land of Tapi district of Gujarat state in India. Our main objective is to study on randomly selected 42 agricultural 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 (P, K and C) by using correlation analysis. This study concludes that 'correlation analysis' can provide scientific platforms for monitoring and controlling the agriculture soil fertility management.***

Keywords: Correlation, Macronutrients, Soil health, Soil Parameters, Tapi.

1. Introduction

Soil is a naturally occurring porous medium that supports the growth of plant and roots by retaining air, heat, water and nutrients and provides mechanical support to the plant. Soil is main and fundamental component of agricultural activity so that it is important and necessary to understand the basic needs of soil. Soil is a natural resource that provides essential nutrients to crope growth, need proper care and management in order to maintain a high degree of soil fertility system. Health and growth of plant is determined through soil fertility and soil fertility is determined by the availability of macro and micronutrients**.** The aim of this paper is to study and determine the relationship between pH, EC and macro nutrients (P, K and C) using descriptive statistical analysis. In this work, Pearson's correlation analysis is used to study 42 random agricultural soil samples collected from different agricultural areas of Tapi [1]-[5].

2. Material and Methods

2.1 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.[6] 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[7] are heavy black and sandy type. Major field crops[8] are Paddy, Sorghum, Sugarcane, groundnut, cotton, and major horticultural crops are mango, sapota, papaya, banana and hostricultural crops-vegitable 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 42 soil samples based from different regions of Tapi district (Gujarat–India) for present study. Numbers of soils samples, names of sample site are shown in table 1. Location of study area 42 samples is shown in location map figure 1

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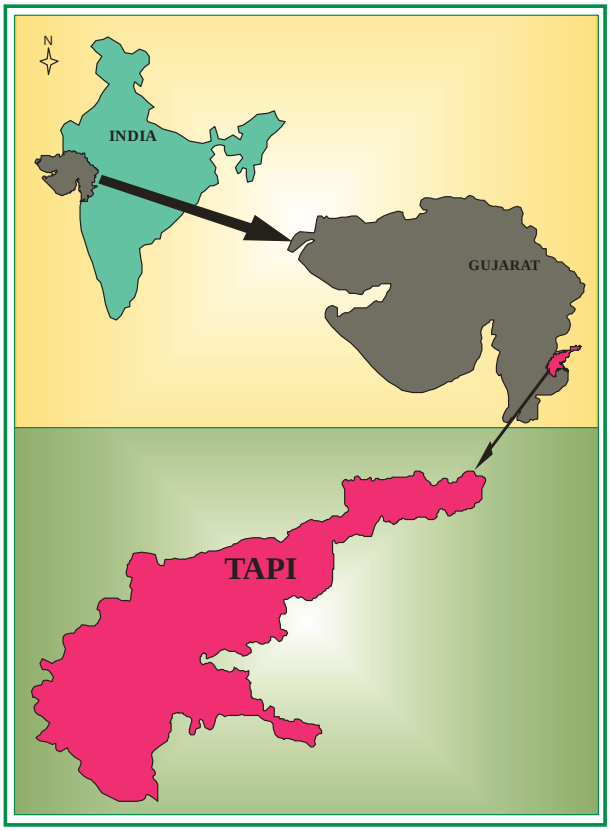

Figure 1: Location map of study area, Tapi district, Gujarat, India

Table 1: Name and numbers of Samples site

Sample No.	Name of Sample Place
6584442	Antapur
6576503	Amoniya
6566959	Ota
6568608	Kapura
6580182	Karanjvel
6576386	Kakdava
6576506	Kakdava
6574602	Kelkui
6579777	Kohali
6580061	Kohali
6581599	Khuntadiya
6581773	Khuntadiya
6582079	Gadad
6566626	Garvan
6578668	Gheriyavav
6568315	Gheriyavav
6578497	Gheriyavav
6578953	Gheriyavav
6581795	Chikhalda
6575478	Chunavadi
6582366	Chhindiya
6837859	Dhamodala
6565718	Nanikhervan
6580730	Paniyari
6582162	Pipalvada
6573542	Bardipada
6570820	Balda
6580437	Borkhadi
6566104	Bhojpur dur
6581392	Musa
6581781	Musa
6565611	Rengan kutch
6581583	Lotarva
6574520	Vankala
6566480	Vanskui
6565617	Vanskui
6838710	Virpor
6566183	Vekur
6580130	Vyara
6566937	Sadagvan
6566957	Sadagvan
6581398	Saraiya

2.2 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 [9] by following the "Methods Manual-Soil Testing in India". The samples were analyzed [10] for physical parameters, organic carbon (OC), phosphorus (P), potassium (K), electrical conductivity (EC) and pH.

2.3 Tools and Techniques

Mean, minimum, maximum and standard deviation (SD) is 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 S.P.S.S., EXCEL.

Table 2: Concentration of soil properties of selected samples from the study area

Patrak No.	pH	EC	C	P	K
06584442	7.2	0.35	0.4	37	316
06576503	7.5	0.35	0.6	65	401
06566959	7.2	0.38	0.53	17	391
06568608	7	0.35	0.57	37	401
06580182	7.2	0.33	0.76	27	406
06576386	7	0.32	0.41	27	431
06576506	7.3	0.36	0.44	37	431
06574602	7	0.36	0.42	67	376
06579777	7.4	0.68	0.6	32	436
06580061	7.3	0.62	0.58	40	436
06581599	7.2	0.38	0.45	32	361
06581773	7.3	0.39	0.42	37	416
06582079	6.9	0.36	0.4	32	396
06566626	7.2	0.37	0.45	12	391
06578668	7.5	0.47	0.42	45	371
06568315	7.4	0.37	0.45	35	361
06578497	7.41	0.38	0.75	47	451
06578953	7.1	0.32	0.38	27	436
06581795	7.4	0.46	0.61	45	391
06575478	6.9	0.38	0.38	55	361
06582366	7.2	0.42	0.45	32	411
06837859	7.3	0.32	0.48	37	463
06565718	7	0.38	0.77	12	391
06580730	7	0.32	0.43	17	396
06582162	6.9	0.32	0.38	45	411
06573542	7.2	0.39	0.6	52	396
06570820	6.9	0.42	0.42	35	401
06580437	7.3	0.79	0.42	45	371
06566104	6.9	0.34	0.44	37	411
06581392	7.4	0.46	0.61	45	376
06581781	7.3	0.42	0.42	37	436
06565611	7.3	0.37	0.44	50	436
06581583	7.2	0.46	0.46	67	406
06574520	7.3	0.4	0.47	45	451
06566480	7	0.36	0.43	39	401
06565617	7.6	0.34	0.44	45	381
06838710	6.9	0.32	0.56	17	416
06566183	7.4	0.32	0.4	20	376
06580130	7.2	0.39	0.4	37	401
06566937	7.2	0.39	0.58	30	381
06566957	7.4	0.38	0.61	42	446
06581398	6.9	0.36	0.61	17	396
Mean	**7.18**	**0.40**	**0.50**	**37.00**	**399.57**
Minimum	**6.90**	**0.32**	**0.38**	**12.00**	**316.00**
Maximum	**7.50**	**0.79**	**0.77**	**67.00**	**463.00**
SD	**0.19**	**0.11**	**0.12**	**13.29**	**30.99**

SD= Standard Deviation

Table 3: Discription of soil properties

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 4: Interpretation of soil properties (Reference: 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 5: Correlations Matrix between soil characteristics

soil parameter	*pH*	*EC*	*C*	*P*	*K*
pH	1				
EC	0.31	1			
C	0.181	0.096	1		
P	0.281	0.195	-0.118	1	
K	0.067	-0.012	0.197	-0.001	1

3. 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 6.9 and 7.6 Soils are slightly acidic to to moderately alkaline in reaction, pH varied from 6.9 to 7.6 with the mean value of 7.19

As presented in table-2 and table 4, (6.9 – 7.6) pH value indicates, Majority samples are neutral. No sample is acidic i.e. pH < 6.5. Electrical conductivity (EC) is varied from 0.12 to 0.85 dS/m with a mean value of 0.40 dS/m. It shows all samples are salt free i.e. values are between 0 - 2 (ref: table 4). Organic carbon (OC) of the soil is varied from 0.38 – 0.77 with a mean value of 0.50 given in table-2. It is very low i.e. < 0.50 in 65% soil samples, medium i.e. 0.50-0.75 in 30% soil samples and 5% samples are with high value i.e. > 0.75. Phosphorus content of studied samples is 12–67 kg/ha given in table-2.

It is observed content of phosphorous in 83% samples are of high range i.e. > 24.6, 7 samples are in medium range and no sample in lower range. It can be attributed to high fertilizer practice. In case of potassium all the samples is in high range, this may be due to use of over fertilization.

Relation among EC, pH and Macronutrients

Correlation matrix in table form is given in table-5. Correlation studies of pH with EC and phosphorus shows strong relationship with r = 0.310 and r = 0.281 respectively, where as positive but not very significant correlation with OC (r = 0.181). Less negative correlation of EC is found with potassium (r = -0.012), while positive but not significant correlation with organic carbon (r = 0.096), phosphorus (r = 0.195). EC is positive but not significant with carbon (r = 0.096). Organic carbon is positively correlated with potassium (r = 0.197) where as it is negatively correlated with phosphorus (r = -0.118). Similar results were reported by Chauhan[11] and R.P.Singh[12].

4. Conclusion

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

1) Result shows positive significant correlation of pH with available potassium and organic carbon.
2) Electrical conductivity has positive but not significant correlation with organic carbon and phosphorus, while it has poor negative correlation with potassium.
3) Organic carbon has positive correlation with potassium.
4) Electrical conductivity and pH inversely correlate with phosphorus.
5) Observation shows negative correlation of EC with potassium.
6) **S**tudy concludes that statistical methods like correlation analysis can provide a scientific basis for controlling and monitoring agriculture soil fertility management.

5. Future Scope

In SHC programme and in most study like present work of this kind was performed for horizontal soil distribution but there is also scope and hope to know the vertical distribution of soil properties

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Author Profile

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