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Original Research Article

A Comparative Study of Various Physical and Chemical Parameters of the Soils of Surendranagar District (Gujarat, India)

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Abstract

Cultivation of crops and yield of crop is highly dependent on the soil where they are grown. Soil contains carbon, nitrogen along with certain other essential requirements. Crops yield is highly dependent on physical and chemical properties of soil as well as on surrounding environment. pH, organic carbon, electric conductance, concentration of micro and macro elements in the soil are responsible for crop yield. Low value of higher concentration of such elements may result into low production. Hence it is very essential to determine the quality of soil before using it for agriculture purpose. Here in this study, concentration of all these parameters were analyzed for a large samples size of Surendranagar district the Gujarat state, India. Obtained results were compared with standard value to determine the fertility of soil.

Keywords

Micro and macro-elements

Soil parameters

Soil quality

Surendranagar

Introduction

Soil is thought to be the major nutrient provider for crop production. Carbon, hydrogen and nitrogen are major components required for the growth of any plant. Apart from these, they also require certain microelements like potassium, sulfur, boron, magnesium, zinc, chlorine and trace elements for their growth. C, H, O and N are backbone of plant as well as also form biomolecule. Micro and trace element are also vital for the growth as they may act as cofactor for activation of certain enzymatic activities, inhibitor to prevent adverse effect on plant, they also directly or indirectly involved in growth and regular activity of plants. For any plant, it becomes primary necessity to have these elements available in the soil in sufficient quantity. If one or more elements are present in lesser concentration than it can be easily provided in form of synthetic chemicals. But higher concentration of any of these components may have on plant (Kinyangi, 2007; Shomar, 2012). Therefore it becomes very essential to analyze the quality of soil before using for agriculture purpose. This analysis will help in finding out the optimum requirement of chemical fertilizer which is essential for maximum crop yield. Not only this, if higher concentration such elements are found in the soil than adequate steps should be taken care for optimum production of crop (Wuana and Okieimen, 2011). The present experiment was planned to study the variation of various parameters of the samples collected from the Surendranagar district. Parameters like pH, electric conductance, organic carbon, P, K, Zn, Fe, S, Mn, Cu, Mg and Ca were analyzed by standard method and results were compared with standard range.

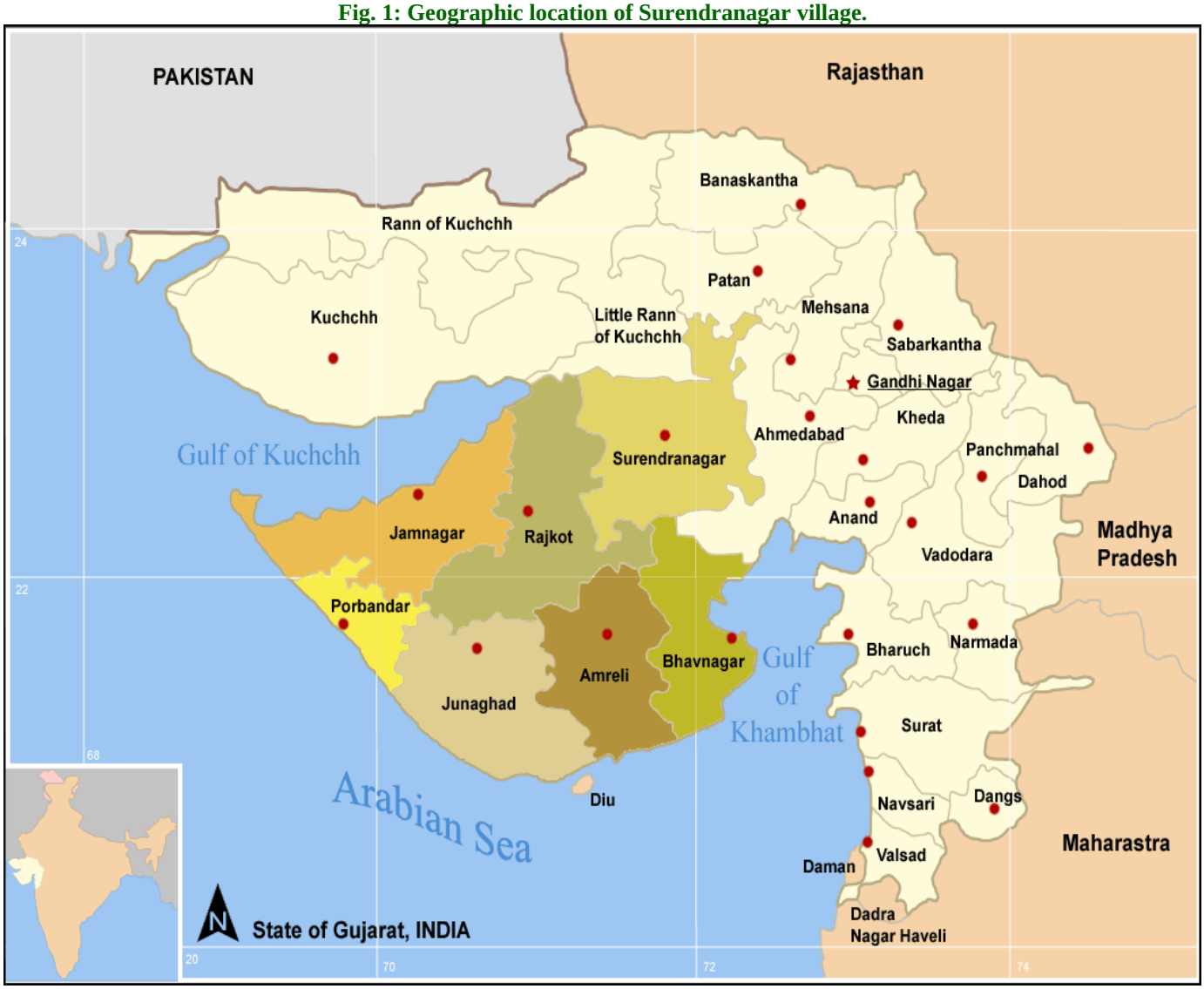
Materials and methods

Geographical location of the study area is presented in Fig. 1. Surendranagar is a part of Saurastra region of Gujarat State. It covers approximately 45 sq km area. It has population of more than 2 lakhs. Its geographical coordinates are 22.430º North, 71.430º East.

Sample collection

A total of 11,955 samples were collected from 210 villages from ten Talukas of the Surendranagar District. Samples were collected as per guidelines issued by Government of India for the analysis of soil (Dept. of Agriculture and Cooperation, 2011).

Fig. 1: Geographic location of Surendranagar village.



Methods of determination of various parameters

For the various analysis of the samples guidelines issued by the Government of India was followed strictly and all the experiment were carried out at least three times (Dept. of Agriculture and Cooperation, 2011). Results were tabulated and statistical analysis was done to check the level of significance using SPSS 16.0.

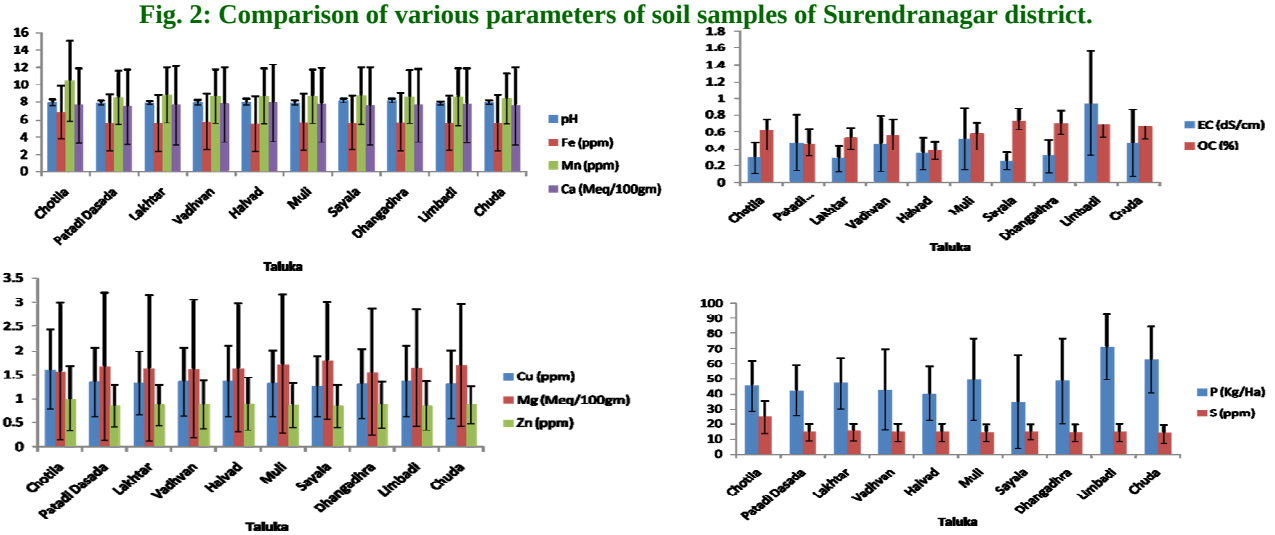
Results and discussion

All the obtained data pertaining to the soil characteristics of different localities of Surendranagar were noted in a tubular and used for the analysis. Here, in the following table, only district wise and taluka wise data are shown with Mean ± SD value. Data were also analyzed village wise but it was not shown here.

Table 1. Comparison of various parameters of soil samples of Surendranagar District.

Taluka	Parameter	pH	EC	OC	P	K	Fe	Cu	Mn	Zn	Ca	Mg	S
Chotila (N = 900)	Mean	7.92	0.29	0.62	45.27	222.58	6.80	1.60	10.47	1.00	7.55	1.56	24.39
	SD	0.41	0.19	0.23	16.75	80.72	2.99	0.83	4.60	0.68	4.26	1.74	10.94
Patadi Dasada (N = 900)	Mean	7.86	0.47	0.46	41.97	266.50	5.63	1.34	8.48	0.84	7.39	1.66	14.57
	SD	0.28	0.33	0.15	16.77	88.02	3.22	0.73	3.03	0.43	4.27	1.86	5.54
Lakhtar (N = 450)	Mean	7.86	0.28	0.53	46.95	260.92	5.58	1.32	8.79	0.86	7.58	1.63	14.69
	SD	0.22	0.16	0.13	17.00	87.21	3.23	0.67	3.16	0.42	4.51	1.82	5.56
Vadhvan (N = 3395)	Mean	7.92	0.46	0.56	42.52	297.20	5.74	1.35	8.63	0.87	7.68	1.61	14.42
	SD	0.32	0.33	0.18	27.04	93.34	3.21	0.72	3.09	0.50	4.26	1.80	5.75
Halvad (N = 540)	Mean	7.96	0.34	0.39	40.13	316.51	5.50	1.36	8.65	0.89	7.93	1.63	14.41
	SD	0.39	0.19	0.12	17.69	96.82	3.19	0.75	3.16	0.56	4.42	1.79	5.65
Muli (N = 4150)	Mean	7.86	0.52	0.58	49.36	234.18	5.69	1.32	8.63	0.85	7.64	1.71	14.16
	SD	0.31	0.37	0.19	27.04	99.94	3.23	0.70	3.08	0.46	4.26	1.88	5.67
Sayala (N = 180)	Mean	8.13	0.25	0.73	34.68	219.19	5.64	1.25	8.71	0.84	7.51	1.78	14.63
	SD	0.26	0.10	0.10	31.00	98.67	3.07	0.64	3.28	0.44	4.50	1.94	5.03
Dhangadhra (N = 720)	Mean	8.12	0.31	0.70	48.19	167.52	5.72	1.31	8.58	0.86	7.58	1.55	14.19
	SD	0.23	0.20	0.13	28.11	96.77	3.32	0.73	3.05	0.48	4.19	1.73	5.63
Limbadi (N = 540)	Mean	7.80	0.94	0.69	71.30	213.48	5.58	1.36	8.55	0.84	7.61	1.64	14.32
	SD	0.24	0.62	0.15	21.84	109.55	3.13	0.75	3.25	0.51	4.25	1.80	5.89
Chuda (N = 180)	Mean	7.90	0.47	0.67	62.74	297.80	5.60	1.30	8.38	0.86	7.50	1.69	13.60
	SD	0.26	0.40	0.15	21.92	98.34	3.22	0.72	2.90	0.39	4.44	1.97	5.94
Total (N = 11955)	Mean	7.90	0.47	0.57	46.95	254.14	5.77	1.35	8.75	0.87	7.63	1.65	15.07
	SD	0.32	0.36	0.19	25.77	103.05	3.21	0.73	3.27	0.50	4.28	1.83	6.78

Fig. 2: Comparison of various parameters of soil samples of Surendranagar district.



From overall analysis of the entire collected 11,955 sample, it was found that the entire Surendranagar region had slightly alkaline soil with pH ranging from 7.80 to 8.13, which is the prime requirement for any crop (Patel et al., 2014; Fernández and Hoeft, 1990). The electrical conductance of whole region was found to be very low as compared to the standard parameters according to which it should be between 1.0 and 3.0. However certain area of Limbadi has shown adequate EC. Except the Patadi Dasada and Halvad all the other villages have normal organic carbon. Patadi Dasada has on an average 0.47%, whereas Halvad has only 0.34% organic carbon. Expect Limbadi and chuda, the entire region posses' sufficient quantity of phosphorus. Both villages had higher concentration of phosphorous which was 71.30 and 62.74 respectively (Sims and Vada, 1996). In case of potassium only Halvad and Chuda has higher concentration, 316.51 and 297.80 respectively.

It was also found that the entire region has also higher concentrations of copper and sulfur. This may be because of geographic location of area which is densely surrounded by rocks and mountains. However the other elements like manganese, zinc and calcium were found in optimum concentration. The higher concentration of

potassium and phosphorus might be use of synthetic fertilizer for better productivity (Fitzpatrick 2009; Lundquist et al., 1999). Similar kinds of results were observed in the previous studies and well documented (Kolay, 2007). When principal component analysis was done for determination of correlation matrix, positive correlation were found between phosphorous and OC, Mn and Fe, Mn and Cu, Zn and Fe, Zn and Cu, S and Fe, S and Cu, S and Mn and S and Zn; whereas no major negative correlation was found.

Table 2. Correlation matrix of various parameters of various factors in soil of Surendranagar.

Correlation Matrix												
	pH	EC	OC	P	K	Fe	Cu	Mn	Zn	Ca	Mg	S
pH	1.000											
EC	-0.149	1.000										
OC	0.049	-0.001	1.000									
P	0.047	0.022	0.182	1.000								
K	-0.045	-0.015	-0.017	-0.037	1.000							
Fe	-0.007	-0.002	0.004	0.004	0.002	1.000						
Cu	-0.018	-0.005	-0.001	-0.008	0.006	0.043	1.000					
Mn	0.004	-0.017	-0.002	-0.002	-0.008	0.320	0.037	1.000				
Zn	0.007	-0.016	0.019	0.005	0.004	0.064	0.410	0.017	1.000			
Ca	-0.001	-0.004	0.007	0.005	0.003	0.008	0.008	-0.006	0.006	1.000		
Mg	-0.005	0.009	-0.003	0.002	-0.007	0.000	-0.001	0.006	-0.008	0.004	1.000	
S	-0.006	-0.063	0.008	-0.019	-0.022	0.089	0.164	0.114	0.119	-0.022	-0.004	1.000

Conclusion

From the overall study, it is concluded that the soil of Surendranagar from where the samples have been collected has all the necessary factors required for the growth of plants except a few metals.

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