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ESTIMATION OF MICRONUTRIENTS AND PHYSICO-CHEMICAL ANALYSIS OF SOILS OF GANDHINAGAR DISTRICT, GUJARAT, INDIA

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ABSTRACT:

Gandhinagar is the capital city of Gujarat State. The paper deals with the estimation of micronutrients and physico-chemical characteristics of soil of different talukas of Gandhinagar district. This district has four talukas with 290 villages and 10 urban habitations in the district. For the study purpose, the entire district was divided into 20 sites. Five sites of each talukas were selected. Total 20 sampling sites were selected to collect samples. The study was carried for a period of 2 years (2011 to 2013). Soil samples were colleted and analysed for their physico-chemical parameters like pH, EC, Alkalinity, Chloride, Hardness, Sodium, Potassium, Phosphorus, Nitrate etc. and micronutrients (Cu, Zn, Mn, Fe). Cu was recorded highest in Gandhinagar district. Zn was recorded medium to high in Dehgam, Mansa and Kalol taluka. Zn was recorded high in this district. Mn value was recorded low to medium. Fe was recorded medium.

KEY WORD: *Soil analysis, Micronutrients.*

INTRODUCTION:

Biologically, soil may be considered as a weathered outer crust of the earth in which remains and products of decay of living organisms are finely mingled. Ecologically, it may be defined as the part of the crust of the earth in which roots of plants are actually growing. Release of mineral elements during decomposition of litter increases fertility of soil (Charly and West, 1975). According to Marbut (1935) soil may be define as, "the natural medium for the

growth of land plants on the surface of the earth composed of organic and mineral materials." Fertile soil is the most important source for the entire living world. Apart from providing a solid substratum on which we live, the soil provides us most of our necessities through the plant and animals communities which develop on it (Asthana and Asthana, 2003). Soil testing is one of the best available tools to ascertain the physical characteristics and nutrient status of a field so as to assess the fertilizer requirement (Singh, 2007).

MATERIALS AND METHODS:

The present study was undertaken for the period of 2 years. The collection was made with repeated field trips. Soil samples were collected during different seasons from selected sites and analyzed for their physico-chemical parameters like pH, EC, Alkalinity, Chloride, Hardness, sodium, Potassium, Phosphorus, Nitrate and micronutrients. The sampling was done by method of Piper (1950). Samples were analyzed as per methods suggested by Trivedy and Goel (1984). Micronutrients were estimated in Atomic Absorption Spectrophotometer (AAS).

RESULTS AND DISCUSSION:

The values of physico-chemical parameters analysed in soil are given in Table-01 and values of micronutrients are given in Table–02. The value of pH was recorded high (8.34) in S_{11} and low (7.71) in S_{14}. pH above 7 indicates the alkaline nature of soil.

EC indicates the presence of electrolytes in soil. The value of EC ranged between 0.31m.mho.cm^{-1} to 0.73m.mho.cm^{-1} in all 20 samples. EC was high in S_2, S_{11} and S_{19}.

Soil with EC greater than 4m.mho.cm^{-1} indicate the salinity in the soil (Sharma and Kaur, 1994). In present study EC ranges from 0.31m.mho.cm^{-1} to 0.73m.mho.cm^{-1} which shows that soil is not saline in nature.

The value of organic carbon was highest (0.71 ppm) in S_{13} and lowest (0.44 ppm) in S_7. Decrease in OC may be due to its high demand by living organisms (Solanki, 2001).

The nitrogen value was found highest (0.052 ppm) in S_{12} and low (0.038 ppm) in S_7. Nitrogen value was quite high (0.050 ppm) and quite low (0.40 ppm) in remain other soil samples (Table-01). The high or low value of nitrate could be correlated with soil organisms that is nitrogen fixing soil algae, as well as nitrifying and denitrifying bacteria and utilization of nitrate by plants and other living organisms including worms etc. for synthesis of amino acids (Singh, 1996 and Ahluwalia, 1999). The value of Phosphorus ranged between 1.19 ppm (S_{20}) to 5.46 ppm(S_8). The P value was found quite high 5.04 ppm (S_{14}) and recorded quite low 1.86 ppm (S_9).

Maximum K value was found in S_{13} (46.4 ppm) and minimum K value was found in S_{12} (20.7 ppm). Wiklander (1958) has reviewed the nature and mechanism of K fixation and its release in an available form through leaching and weathering processes.

The value of chloride was ranged between 53.7 ppm (S_2) to 271.5 ppm (S_6). Alkalinity in natural waters and soils is formed due to dissolution of CO_2 (Trivedy and Goel, 1986). The maximum value (618.1 ppm) of alkalinity was observed in S_2 and minimum value (183.3 ppm) was recorded in S_{19}.

Total hardness is mainly due to the presence of Ca and Mg hardness (Trivedi and Goel, 1986). Maximum value (251.5 ppm) of TH was obtained in S_{16} and minimum TH value (40.9 ppm) in S_{10} (Table - 01).

Micronutrients are those elements essential for plant growth which are needed in only very small (micro) quantities. These elements are sometimes called minor elements or trace elements. In general, most plants grow by absorbing nutrients from the soil. Their ability to do this depends on the nature of the soil.

Copper (Cu) is important for reproductive growth and helps in the utilization of proteins. The value of Cu ranged between 0.38ppm to 1.68ppm. It was recorded medium in S_1 and was recorded high in remain other samples (Table-02). Zinc (Zn) is essential for the transformation of carbohydrates and regulates consumption of sugars. It is the part of the enzyme systems which regulate plant growth. In present study the Zn value is medium in S_6, S_9, S_{12}, S_{13}, S_{16} and S_{18} (Table-02). Manganese (Mn) functions with enzyme systems involved in breakdown of carbohydrates, and nitrogen metabolism. Soil is a source of manganese. The Mn value ranged between 4.28ppm to 12.52ppm. Iron (Fe) is essential for formation of chlorophyll. The level of Fe in soil of Gandhinagar district is different. It ranged between 3.29ppm to 8.93ppm (Table-02).

CONCLUSION:

The present study was carried out on 20 selected sites located at four talukas of Gandhinagar district. In present study physico-chemical characteristics of soil were estimated. Soil samples were analysed for their physico-chemical properties like pH, EC, Organic Carbon, Alkalinity, Chloride, Hardness, Nitrogen (N), Phosphorus (P), Potassium (K) and also analysed for micronutrients like Zn, Cu, Mn, and Fe. In present study some physico-chemical parameters were high and some were low in all samples. Cu was recorded highest in Gandhinagar taluka (Graph-01). Zn was recorded medium to high in Dehgam, Mansa and Kalol taluka (Table-02). Mn value was recorded low to medium (Graph-03). Fe was recorded medium (Graph-04).

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Table – 01 Physico-chemical characteristics of soils (Year-2011 to Year-2013)

Parameters	Samples									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
pH	7.98	7.78	8.11	8.04	7.96	8.16	7.94	7.85	8.12	7.92
EC	0.64	0.43	0.46	0.47	0.64	0.41	0.55	0.38	0.38	0.47
Organic C	0.52	0.51	0.60	0.52	0.59	0.48	0.44	0.53	0.50	0.50
Nitrogen	0.045	0.042	0.050	0.044	0.050	0.040	0.038	0.046	0.042	0.043
Phosphorus	2.88	3.62	4.16	4.44	4.56	3.13	3.20	5.46	1.86	2.58
Potassium	30.8	31.6	29.4	31.5	26.7	43.9	42.1	38.0	20.9	27.1
Chloride	59.8	53.7	77.5	76.0	112.7	104.8	68.3	87.7	101.8	71.8
Alkalinity	372.6	618.1	435.5	368.8	317.0	363.4	474.5	357.1	366.4	218.1
Calcium	64.5	76.1	74.6	73.9	74.2	50.1	42.6	31.9	53.5	20.9
Magnesium	55.9	87.1	67.9	60.1	67.9	60.5	36.2	38.3	47.2	22.3
Total Hardness	120.5	164.0	111.02	134.1	142.2	110.7	71.3	70.7	91.9	40.9
Sodium	4.72	3.82	4.15	4.26	2.71	1.96	3.40	3.04	2.81	3.91
	11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
pH	8.34	7.92	8.28	7.71	7.96	7.79	7.79	7.78	7.77	7.96
EC	0.73	0.44	0.31	0.52	0.40	0.42	0.45	0.41	0.60	0.59
Organic C	0.56	0.61	0.71	0.47	0.49	0.60	0.59	0.59	0.56	0.58
Nitrogen	0.047	0.052	0.061	0.039	0.042	0.051	0.049	0.050	0.060	0.060
Phosphorus	2.13	4.23	3.92	5.04	4.38	3.34	2.28	2.12	3.75	1.19
Potassium	29.2	20.7	46.4	32.8	30	28.9	27.6	30.6	33.5	31.3
Chloride	85.8	80.2	73.9	73.7	54.8	82.1	57.6	73.7	56.1	59
Alkalinity	262.2	369.9	284.6	295.1	432.8	387.9	338.9	271.7	183.3	292.9
Calcium	39.4	46.6	60.3	59.3	87.5	68.7	57.5	72.7	36	38.1

Parameters	Samples									
Magnesium	40.7	52.8	44.9	42.5	61.7	102.7	48.3	21.2	38.5	32.8
Total Hardness	81.4	88.6	105.4	88.5	149.4	251.5	216.0	170.0	124.8	162.4
Sodium	3.76	2.95	2.88	3.71	3.01	4.81	4.04	4.93	3.83	4.05

Parameters in ppm, except pH, EC = m mho/cm [Mean of summer, monsoon and winter]

Table – 02 Recorded values of Micronutrients of soils (Year-2011 to Year-1013)

SAMPLES	MICRONUTRIENTS							
	Cu ppm	Class	Zn ppm	Class	Mn ppm	Class	Fe ppm	Class
1	0.38	Medium	1.42	High	5.79	Medium	3.68	Low
2	0.72	High	2.01	High	8.09	Medium	8.40	Medium
3	0.78	High	1.76	High	8.20	Medium	6.01	Medium
4	0.73	High	1.46	High	5.78	Medium	7.01	Medium
5	0.73	High	2.48	High	12.52	High	5.56	Medium
6	0.63	High	0.81	Medium	7.99	Medium	5.56	Medium
7	0.57	High	2.49	High	7.52	Medium	8.93	Medium
8	0.73	High	2.23	High	11.25	High	5.45	Medium
9	0.69	High	0.95	Medium	6.93	Medium	6.08	Medium
10	0.44	High	1.83	High	9.52	Medium	6.99	Medium
11	0.71	High	1.26	High	8.26	Medium	8.21	Medium
12	0.87	High	0.85	Medium	8.90	Medium	4.33	Medium
13	0.81	High	0.93	Medium	4.28	Low	5.63	Medium
14	0.89	High	1.21	High	6.48	Medium	5.42	Medium
15	1.68	High	1.92	High	10.71	High	6.64	Medium
16	1.37	High	0.83	Medium	7.65	Medium	6.78	Medium
17	0.98	High	1.05	High	7.58	Medium	5.03	Medium
18	0.93	High	0.88	Medium	8.38	Medium	6.21	Medium
19	1.08	High	1.24	High	7.61	Medium	7.58	Medium
20	0.68	High	1.24	High	5.51	Medium	3.29	Low

[Source: Present study]

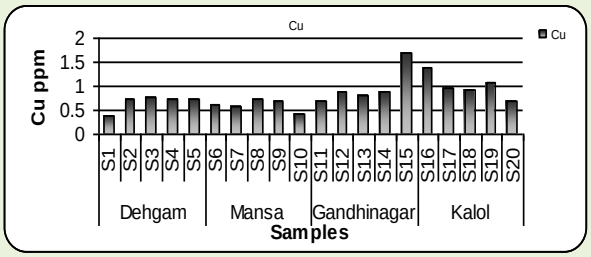
Table – 03 Level of micronutrients in different taluka of Ganndhinagar district, Gujarat, India

Taluka	Micronutrients							
	Cu ppm	Class	Zn ppm	Class	Mn ppm	Class	Fe ppm	Class
Dehgam	0.66	High	1.82	High	8.07	Medium	6.13	Medium
Mansa	0.61	High	1.66	High	8.64	Medium	6.60	Medium
Gandhinagar	0.99	High	1.23	High	7.72	Medium	6.04	Medium
Kalol	1	High	1.04	High	9.34	Medium	5.77	Medium

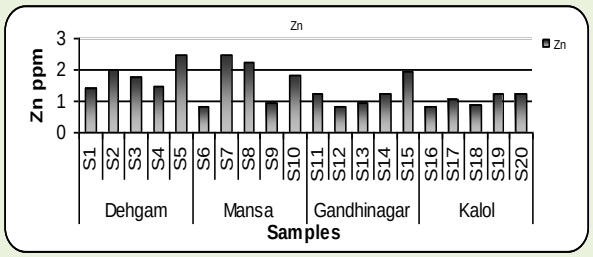
[Source: Present study]

Table – 04 Level of micronutrients in Ganndhinagar district, Gujarat, India

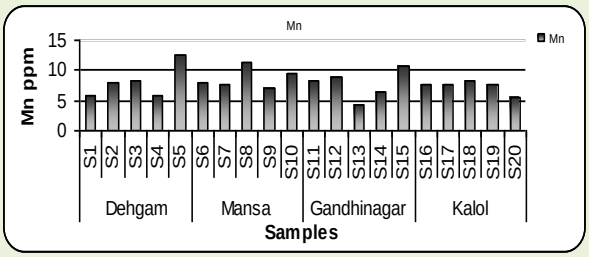
GANDHINAGAR DISTRICT			
Micronutrients [Cu, Zn, Mn, Fe]			
Copper [Cu]	Zinc [Zn]	Manganese [Mn]	Iron [Fe]
High	High	Medium	Medium



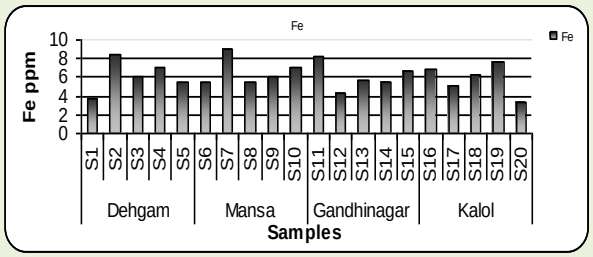
Graph – 01



Graph – 02



Graph – 03



Graph - 04

The difference of micronutrients in different talukas of Gandhinagar district