



## Study on physico-chemical properties of soil sample in Vijapur taluka, District Mehsana

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### Abstract:

Study of the soil quality carried out in various villages of Vijapur taluka, district Mehsana, Gujarat. Five representative locations were selected for the study and 20 samples from each location and direction of area were collected. The soil is the most important constituent to fulfilment of all the basic needs of human beings. Soil is an important component of our farming. Physico-chemical study of soil is based on various parameters like pH, electrical conductivity, calcium, magnesium, sulphur, organic carbon, potash, phosphorous, copper, iron, manganese and zinc. Low, medium & high range of above parameter also calculated from analysis data. This knowledge will help to the people who are interested to work in agricultural field. This information will be helpful to the farmers to solve the problems related to soil nutrients amount of which fertilizers to be added to soil to increase the yield of crops.

**Keywords:** Soil, pH, Electrical conductivity, Agricultural, Fertilizers

### Introduction:

The particle shape of sediments, soils, and rocks, moisture contents have influences on important transport properties, such as electrical conductivity [1], dielectric permittivity [2], soil resistivity, thermal conductivity, and hydraulic conductivity. Soil electrical resistivity depends on soil water content as well as dry density of data fields [3]. Soil resistivity also depends on soil texture (especially content of clay), soil type and water holding capacity and the amount of dissolved ions in pore water [4-5]. A soil test will assess the present's levels of major plant nutrients, soil pH, micronutrients and provide an estimate of total soil lead. Recommendation will include the amounts of limestone and fertilizer, if necessary, to meet the requirements of the specific plant or crop being grown. If elevated soil lead levels are indicated, appropriate information will be including with your results to address this problem. Different studies have shown that the most of the plant nutrients are optimally available to plants at pH range between 6.5 to 7.5 ranges [5-7].

Sustainable agriculture aims at long term maintenance of natural resources and agricultural productivity with minimal adverse impact on the environment. It emphasizes optimal crop production with minimal external inputs, reducing dependence on commercial inputs (fertilizers and pesticides) and substituting them with internal resources. Various researchers have studied on physico-chemical characterization of farmland soil [7 - 9]. Many researchers have studied on soil fertility of various soil samples [8-12].

### **Plant Nutrients**

Although plants absorb a large number of elements, all of them are not essential for the growth of plant. The elements which are required by plant for their normal growth, development, metabolism and to complete their life cycle are called the essential ones. Some of these are required in large amounts and some in traces. Nutrients are classified as Primary (Macro), Secondary and micro, and are further classified as follow:

#### **Major nutrients required for plant growth**

Class 1: Carbon, hydrogen and oxygen (C,H, O).

Class 2: Nitrogen, potassium and phosphorus.

**Secondary Nutrients:** Magnesium, Calcium and sulphur

**Micro nutrients:** Iron, boron, zinc, molybdenum, manganese, copper and chlorine.

Soil testing can be divided into four steps (1) sampling (2) analysis (3) interpretation and

(4) recommendations. One of the most important aspects of soil testing is that of obtaining a

representative sample of the area.

### **CHEMICAL & EQUIPMENTS**

Potassium chloride, Buffer tablate, Sulphuric acid, Potassium dichromate, Sodium bicarbonate, activated charcoal (phosphorous free), Ammonium molybdate, Stannous chloride, Ammonium acetate, Calcium chloride, Glacial acetic acid, Barium chloride, Gum acacia, Sodium diethyl dithiocarbamate, Sodium hydroxide, Muroxide, Ethylene di amine tetraacetate, Ammonia buffer, Diethylenetriamine pentaacetic acid, Eriochrome black-T, were procured from s.d. fine chem Ltd. All chemicals are of analytical grade reagent.

pH was measured on pH meter (systronics Model No-335), Conductivity was measured on conductivity meter (systronics Model No-304), Optical density was measured on colorimeter (systronics Model No-202), Analytical balance (Wensar Model No-PGB200) was used to weigh samples and reagents, Flame photometer (systronics Model No-128) was used for analysis of Potash, Micro Nutrients was analyzed on Double beam atomic absorption spectrophotometer (Elico Model No-SL 194).

## METHOD OF ANALYSIS:-

### (1) Calcium

5 g air dried soil sample was taken in 150 ml conical flask and 25 ml of neutral normal ammonium acetate was added. Shaken it on mechanical shaker for 5 min, and filtered through Whatman filter paper No.1. 10 ml filtrate solution was taken in conical flask, and 2-3 crystals of sodium diethyl dithiocarbamate were added. Then 5 ml 16% sodium hydroxide and 40-50 mg of the murexide indicator were added. Titrate it with 0.01N EDTA solution till the color gradually changes from orange red to reddish violet (purple), note the titrated EDTA solution.

### (2) Potassium

#### Method for graph factor of Potassium

Prepared following stock solution and from it make various potash ppm solutions and run in flame photometer and note down potash ppm the reading.

**Table No-1: Reading for Standard Graph of Potassium**

Flask No	Stock solution	Concentration of Pottash in 100 ml Volumetric Solution (ppm)	Reading of Flame Photometer
1	0.0ml (Blank)	-----	0
2	1.0ml	10ppm	39
3	1.5ml	15ppm	48.5
4	2.0ml	20ppm	56.5
5	2.5ml	25ppm	68.5
6	3.0ml	30ppm	78
7	4.0ml	40ppm	100
	Total	140ppm	390.5

#### Calculation

$$\begin{aligned}
 1 \text{ Reading} &= \text{Total Solution of ppm} / \text{Total Reading} \\
 &= 140 / 390.5 \\
 &= 0.359
 \end{aligned}$$

$$\begin{aligned}
 1 \text{ Gram Soil} &= R \times 0.359 \times 5 \text{ Microgram K} / \text{Gram Soil} \quad (0.359 \text{ Graph Factor}) \\
 R &= \text{Flame Photometer Reading of sample}
 \end{aligned}$$

#### **K**

$$\text{Kg/Hectare} = R \times 0.359 \times 5 \times 2.24 \quad (2.24 = \text{Factor in } \mathbf{K} \text{ Hectare})$$

#### **K<sub>2</sub>O**

$$\begin{aligned}
 \text{Kg/Hectare} &= R \times 0.359 \times 5 \times 2.24 \times 1.20 \quad (1.20 = \text{Factor in } \mathbf{K}_2\mathbf{O} \text{ Hectare}) \\
 &= R \times 4.824
 \end{aligned}$$

**Process:**

5 g soil sample was taken in 100 ml conical flask. 25 ml 1 M neutral ammonium acetate solution was added. Shaken it for 5 minutes on shaking machine and filtered the solution on whatman filter paper. Flame photometer was calibrated by using 10, 20, 30, 40, 50, 60, 70, 80 and 90 ppm standard potassium solution. After calibration run above filtrate for analysis and note down the reading.

**(3) Micronutrients (Cu, Fe, Mn, Zn) analysis by AAS**

**Preparation of D.T.P.A extracting solution**

1.967 g D.T.P.A. and 13.3 ml triethanol amine were taken in 500 ml flask. 400 ml distilled water was added. 1.47 g calcium chloride dihydrate was taken in 1ltr flask and dissolved in 400 ml distilled water. To this solution, previously prepared D.T.P.A. & T.E.A. solution was added and pH was adjusted to 7.3 by using add 1M HCl. Make up 1 ltr with distilled water.

**Analysis method for micronutrients (Cu, Fe, Mn, Zn)**

Weighted 20 g dried soil sample in a plastic bottle, then added 40 ml of D.P.T.A. solution. Shake on mechanical shaker for 2 hrs. Filtered it on whatman filter No. 40 in funnel cum test tube. Prepared standard curve for element by using different working ppm solution as per standard method of analysis and condition suggested by Elico brochure and then run the sample and note the ppm of elements. Obtained ppm reading multiplied with factor 2.0.

**(4) Carbon**

**Method for making standard graph for Organic carbon.**

Weighed out 1.25 g sucrose and taken it into 250 ml of volumetric flask and dissolved in 1 N of potassium dichromate solution, and makes up 250 ml volume by using 1 N potassium dichromate. 7 glass beakers of 50 ml were taken and numbered from 1 to 7. 0 ml, 1 ml, 2 ml, 3 ml, 4 ml, 5 ml and 6 ml solution was taken into above beakers from prepared solution of potassium dichromate. Taken 10 ml 1 N potassium dichromate solution and 20 ml conc. sulphuric acid in test-tube and placed for 30 minutes. Allowed to cool and added 20 ml distilled water. Prepared following different standard carbon ppm solution and measured optical density (O.D.) by using red filter.

**Table No-2: Reading for Standard Graph of Carbon**

Sr. No	ml of sucrose solution diluted in potassium dichromate	Amount of sucrose	O.D.
1	0 (blank)	-----	0
2	1	0.005 g	29

3	2	0.010 g	67
4	3	0.015 g	96
5	4	0.020 g	122
6	5	0.025 g	155
7	6	0.030 g	182
	Total	0.105 g	651

**Calculation:-**

**1 Reading**

$$\begin{aligned}
 \text{1 Reading} &= \text{Total Amount of Sucrose} / \text{Total Reading} \\
 &= 0.00016129 \\
 &= 0.000161043 \text{ gm Sucrose}
 \end{aligned}$$

1 Reading Carbon value:

$$\begin{aligned}
 &0.00006774 \\
 &0.00006764 \text{ gram organic carbon}
 \end{aligned}$$

$$\begin{aligned}
 \text{1 Reading Graph Factor Value} &= 0.000067638 \times 100 \\
 &= 0.0067638
 \end{aligned}$$

**Process:**

Taken 1.0 g soil sample in 100 ml beaker. 10 ml 1 N Potassium dichromate solution and 20 ml conc. Sulfuric acid were added to the sample and cooled the solution for 30 minutes. 20 ml distilled water was slowly added and allowed for 12 hrs for oxidation. Then first set zero optical density using blank solution (as above method without taking soil sample). Measured optical density (O.D.) of soil sample by using red filter and note down the reading.

**(5) Sulphur**

**Method for making standard graph for Sulphur**

Weighted out 5.434 g potassium sulphate and make up 1 Ltr by using distilled water (this solution contains 1000 ppm of sulphur). 25 ml this solution was taken and make up 1 Ltr with distilled water (this is working standard solution of sulphur). Taken 0.0 (Blank), 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, and 10 ml working solution in 25 ml volumetric flask. In every flask 1.0 g barium chloride and 1 ml gum acacia solution were added, and make up 25 ml by using distilled water. Then optical density of blank solution was set to zero using blue filter.

**Table No-3: Reading for Standard Graph of Sulphur**

Sr. No.	Working standard sulphur solution in ml	Ppm	O.D.
1	0	0	0
2	1	1	12
3	2	2	22
4	3	3	33
5	4	4	45
6	5	5	56
7	6	6	70
8	7	7	90
9	8	8	110
10	10	10	125
	Total ppm	46	Total: 563

**Calculation:-**

**1 Reading** = Total ppm of Sulphar/Total reading

$$1 \text{ Reading} = 46/563$$

$$=0.08$$

Sulphar ppm or mg/kg

Sulphar ppm or mg/kg = sample reading X graph Factor X 50 X 25 /20 X 10

Sample Reading X 0.084871 X 50 X 25/200

**Sulphar ppm = Sample Reading X 0.530443 or mg/kg**

**Process:**

10 g air dried soil sample was taken in 150 ml conical flask. 50 ml 0.15% calcium chloride extracting solution was added and shaken on mechanical shaker for 30 min. Filtered it on whatman filter No. 42. 20 ml filtrate was taken in 25 ml volumetric flask. 2 ml glacial acetic acid, 1 g crystal of barium chloride and 1 ml gum acacia solution were added. Make up the volume to 25 ml, then first set zero optical density using blank solution (as above method without taking soil sample). Measured optical densities (O.D) of above prepared sample by using blue filter.

**(6) Magnesium**

5 g air dried soil sample was taken in conical flask. To this, 25 ml of neutral ammonium acetate solution was added. The solution was shaken on mechanical shaker and filtered through Whatman (No.1) filter paper. 5 ml solution was pipetted out in conical flask. To this solution, 2-3 crystal sodium diethyl dithiocarbamate, 5 ml of ammonium chloride-ammonium hydroxide buffer solution and 3-4 drops of

Eriochrome black-T indicator were added. Titrated it slowly against 0.01 M EDTA solution. At the end point color changed from wine red to blue.

**(7) Phosphorus**

**Method for making standard graph for phosphorus.**

0.439 g previously dried potassium dihydrogen orthophosphate was dissolved in 500 ml distilled water and 25 ml 7.0 N Sulphuric acid solution was added and then makes up 1 Ltr by using distilled water. 10 ml above solution was taken and makes up 500 ml by using distilled water (1 ml this resulting solution is equivalent to 2 ppm of phosphorus). By using this solution, various standard phosphorus ppm solutions were prepared and measured and their optical densities (O.D) were measured by using red filter.

**Table No-4: Reading for Standard Graph of Phosphorous**

Flask No	2 ppm Working Solution of Phosphorous	8.5 pH Solution of Sodium Bicarbonate	1.5 Percentage Solution of Ammonium Molybdate-HCl	Working Solution of Steanus Chloride	O.D
1	0 Blank	5 ml	5 ml	1 ml	0
2	1 ml = 2 ppm	5 ml	5 ml	1 ml	22
3	2 ml = 4 ppm	5 ml	5 ml	1 ml	39
4	3 ml = 6 ppm	5 ml	5 ml	1 ml	57
5	4 ml = 8 ppm	5 ml	5 ml	1 ml	81
6	5 ml = 10 ppm	5 ml	5 ml	1 ml	102
7	10 ml = 20 ppm	5 ml	5 ml	1 ml	200
	Total = 50 ppm				501

**Calculation**

1 Reading

$$\begin{aligned}
 &= \text{Total Solution of ppm} / \text{Total Reading} \\
 &= 50 / 501 \\
 &= 0.100 \\
 &0.1010 \text{ Microgram P (Graph Factor)}
 \end{aligned}$$

1 Gram Soil = R X 0.1010 X 4 Microgram P/ Gram Soil

R =Colorimeter Reading of Sample                      0. 1010= Graph Factor

P Kg/ Hectare = R X 0.1010 X 4 x 2.24                      (2.24 = Factor in 'P' Hectare)

P<sub>2</sub>O<sub>5</sub> Kg/ Hectare = R X 0.1010 X 4 x 2.24 X 2.29                      (2.29 = Factor in 'P<sub>2</sub>O<sub>5</sub> ' Hectare)

P<sub>2</sub>O<sub>5</sub> Kg/ Hectare = R X 2.0723584

**Process:**

2 g soil sample and 40 ml 0.5 M sodium bicarbonate ( 8.5 pH ) solution were taken in 100 ml beaker. To this, 1 g phosphate free activated charcoal was added and shaken on shaker for 30 minutes. The solution was filtered and pipette out 5 ml. 5ml 1.5% ammonium molybdate-hydrochloric acid solution was added to this solution. Allow to stand for 30 minutes, then 1ml 0.016 M stannous chloride solution was added & make up 25 ml using distilled water. Blank solution was prepared according to the above process without taking the soil sample. Red filter was used and zero optical density was set by using above blank solution, then put the above sample solution and note the optical density.

**(8) Electrical Conductivity (E.C.)**

10 g soil and 20 ml distilled water were taken in 50 ml beaker. It was stirred for 30 minutes. The temperature of E.C. meter was adjusted at 25 °C then conductance was adjusted to 1.412 mS/cm by using 0.01 N KCl solution. Washed the electrode with distilled water and cleaned with filter paper. Immerses electrode in above suspense solution and note the reading.

**(9) pH**

10 g soil & 20 ml distilled water were taken in 50 ml beaker & stirred for 30 min. In 50 ml beaker taken 10 g soil and added 20 ml distilled water and stir for 30 min. Adjusted the temperature of pH meter at 25 °C. Calibrated the pH meter using 4, 7.0, 9.2 pH buffer solution. Washed the electrode with distilled water and clean by filter paper. Immerses electrode in above suspense solution and note the reading.

**Result and Discussion**

**Soil sampling**

Soil sampling was done during the dry season. Soil sampling was done at five randomly located points within each farm. The soils were sampled at two depths, 0 to 15 cm, 15 to 35 cm, using mini-soil pits dug at each sampling point. The soil samples were air dried in the laboratory and sieved through a 2 mm sieve for different types of laboratory analyses.

The Results of soil samples & its LMH data shown in table no: 7(A), 7(B), 8(A), 8(B), 9(A), 9(B), 10(A), 10(B), 11(A), and 11(B).



**Table No-5: Critical Limits of Nutrients:-**

**Calculation of soil fertility Index:**

$$= \frac{(\% \text{ of Low} \times 1) + (\% \text{ of Medium} \times 2) + (\% \text{ of High} \times 3)}{100}$$

Sr.No	Parameters	Unit	Critical Limits		
			Low	Medium	High
1	pH	-----	<6.5	6.5-8.2	>8.2
2	Electric Condtnce.	-----	<1	1-3	>3
3	Organic carbon	%	<0.51	0.51-0.75	>0.75
4	Phosphorous	Kg/Hectare	<26	26-60	>60
5	Potash	Kg/Hectare	<151	151-300	>300
6	Zinc	ppm	<0.5	0.5-1.0	>1.0
7	Ferrous	ppm	<5	5-10	>10
8	Sulphur	ppm	<10	10-20	>20
9	Manganese	ppm	<5	5-10	>10
10	Copper	ppm	<0.2	0.2-0.4	>0.4
11	Magnesium	ppm	<1.0	1.0-2.0	>2.0
12	Calcium	ppm	<1.5	1.5-3.0	>3.0

**Table No-6: Calculation of Low, Medium, High rating of soil fertility Index:**

Sr. No.	Range	Rating
1	Less than 1.67	Low
2	1.67 to 2.33	Medium
3	Greater than 2.33	High

**Table No-7(A): Analysis of soil sample**

**Samples site:** Village : Dabhala, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/Hectare)	Pottash (Kg/Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
1	8.83	0.14	0.18	51.81	286.03	1.72	5.84	30.77	7.18	0.56	0.3	10.7
2	8.6	0.27	0.39	31.09	288.23	0.6	5.98	35.01	6.12	1.84	1.95	11.15
3	8.39	0.3	0.41	62.17	242.66	0.86	6.6	14.32	24.46	1.48	1.1	9.7
4	8.31	0.14	0.4	58.03	201.48	0.4	5.9	23.87	15.66	1.58	1.8	11.2
5	8.57	0.53	0.63	53.88	252.54	1.02	3.64	15.91	10.06	1.2	1.05	10.65
6	8.36	0.27	0.25	62.17	390.89	0.34	4.28	32.36	7.16	0.56	2	10.3
7	8.91	0.52	0.27	47.66	200.93	0.42	8.6	31.83	5.96	1.16	10.15	11.25
8	8.64	0.13	0.24	37.3	172.94	0.4	12.6	16.44	4.92	0.72	2.15	13.35
9	8.73	0.35	0.32	51.81	198.19	0.4	4.98	30.24	7.06	1.38	4.9	13.7
10	8.44	0.28	0.32	45.59	248.15	0.72	7.32	18.57	11.56	2.16	9.4	18.3
11	8.21	0.1	0.14	41.45	182.27	0.38	4.84	23.87	3.52	1.04	1.45	6.65
12	8.64	0.27	0.32	51.81	172.39	0.48	5.98	29.7	7.2	1.86	0.55	13.95
13	8.66	0.21	0.23	49.74	183.92	0.48	5.68	25.99	5.04	0.5	1.1	10.8
14	8.73	1.6	0.47	43.52	176.23	0.72	3.3	20.69	25.98	1.16	1.05	15.05
15	8.71	0.57	0.54	66.32	248.15	0.38	11.3	18.57	4.3	2.5	1.45	17.25
16	7.49	0.3	0.18	62.17	379.36	0.5	3.22	44.03	6.98	1	2.8	11
17	9.36	0.15	0.17	33.16	261.32	0.46	1.96	19.63	7.48	0.94	1.65	12.25
18	7.9	0.16	0.15	24.87	269.01	0.24	1.96	16.44	5.8	0.66	1.3	17.4
19	9.03	0.1	0.22	39.37	183.37	0.26	6.54	29.17	10.24	0.82	0.7	17.1
20	8.47	0.13	0.24	31.09	175.68	0.26	4.5	50.92	11.3	0.68	1.1	12.5

\*=Miliequivalent

**Table No-7(B): Soil Fertility Index & Soil Test Rating**

**Samples site:** Village : Dabhala, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C	Org. Carbon (%)	Phosphorous (Kg/Hectare)	Potta sh (Kg/Hectare)	Zn pp m	Fe pp m	Sulp hur ppm	Mn pp m	Cu pp m	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
L	0	19	18	1	0	13	9	0	3	0	3	0
M	2	1	2	15	18	5	9	7	10	0	12	0
H	18	0	0	4	2	2	2	13	7	20	5	20
%L	0	95	90	5	0	65	45	0	15	0	15	0
%M	10	5	10	75	90	25	45	35	50	0	60	0
%H	90	0	0	20	10	10	10	65	35	100	25	100
S.F.I.*	2.90	1.05	1.10	2.15	2.10	1.45	1.65	2.65	2.20	3.00	2.10	3.00
LMH** of SFI	H	L	L	M	M	L	L	H	M	H	M	H

\*= Soil Fertility Index, \*\*= Low, Medium, and High Soil Fertility Index

**CONCLUSION:-** It is Concluded from above Analysis that E.C., organic carbon , Zn and Fe are in low amount , farm yard manure, ferrous ammonium sulphate & Zn sulphate should be added for better plant and growth & Productivity. The other parameters are in sufficient in limit. pH is in high Limit so it can be neutralized by using acidic fertilizer.

**Table No-8(A): Analysis of soil sample**

**Samples site:** Village : Jantral, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
1	8.35	0.29	0.45	51.81	635.74	0.48	14.7	36.6	21.9	1.72	1	11.2
2	8.25	0.32	0.61	60.1	628.06	0.26	14.5	39.78	22.2	1.78	0.95	15.25
3	8.35	0.32	0.49	72.53	530.33	0.34	14.6	35.54	23.5	1.52	0.9	14.2
4	8.31	0.4	0.49	76.68	566.57	0.24	13.5	39.78	19.1	1.62	1.95	10.65
5	8.19	0.95	0.62	53.88	528.69	0.22	13.8	40.31	16.8	1.48	0.95	11.15
6	8.28	0.63	0.48	66.32	534.73	0.28	14.3	41.37	19.8	1.74	1.1	11.3
7	8.26	0.81	0.51	58.03	634.64	0.26	12.9	32.36	19.2	1.6	1.35	12.15
8	8.75	0.3	0.46	68.39	569.86	0.36	13.6	36.07	20.1	1.6	0.7	16.9
9	8.44	0.93	0.45	55.95	613.23	0.28	13.7	37.13	24.6	1.6	1.95	13.75
10	8.57	0.72	0.55	82.89	525.94	0.34	14.3	32.36	22	1.68	1.95	12.65
11	8.8	0.36	0.71	64.24	588.24	0.46	14	33.95	25.1	1.92	2	12.8
12	8.68	0.43	0.66	78.75	640.13	0.32	14	39.25	28.9	1.98	3.8	10.2
13	8.64	0.36	0.88	62.17	513.32	0.34	14.5	35.01	29.8	2.1	3.75	9.95
14	8.75	0.37	0.66	70.46	562.56	0.34	13.8	39.25	32.2	2.12	3.05	10.35
15	8.63	0.44	0.59	74.6	563.27	0.34	14.4	38.19	30.2	2.28	3.85	10.15
16	8.53	0.54	0.62	51.81	539.67	0.54	14.4	38.19	29.8	2.08	2.2	8
17	8.51	0.44	0.57	58.03	644.09	0.34	13.7	39.78	29.3	2	2	9.8
18	8.64	0.37	0.48	62.17	512.77	0.4	14.5	35.01	22.8	1.9	2.35	9.75
19	8.5	0.54	0.66	72.53	612.68	5.62	15.7	32.36	34.7	2.92	2.2	9.4
20	8.6	0.41	0.57	58.03	605	0.56	9.9	36.6	29.7	2.28	3.55	10.65

\*=Miliequivalent

**Table No-8(B): Soil Fertility Index & Soil Test Rating**

**Samples site:** Village : Jantral, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
L	0	20	7	0	0	17	0	0	0	0	4	0
M	1	0	12	7	0	2	1	0	0	0	8	0
H	19	0	1	13	20	1	19	20	20	20	8	20
%L	0	100	35	0	0	85	0	0	0	0	20	0
%M	5	0	60	35	0	10	5	0	0	0	40	0

%H	95	0	5	65	100	5	95	100	100	100	40	100
S.F.I.*	2.95	1.00	1.70	2.65	3.00	1.20	2.95	3.00	3.00	3.00	2.20	3.00
LMH** of SFI	H	L	M	H	H	L	H	H	H	H	M	H

\*= Soil Fertility Index, \*\*= Low, Medium, and High Soil Fertility Index

**CONCLUSION:-** It is Concluded from above Analysis that E.C & Zn are in low amount for Zinc sulphate should be added for better plant and growth & Productivity. The other parameters are sufficient in limit. pH is in High limit so it can be Neutralized by using acidic fertilizer.

**Table No-9(A): Analysis of soil sample**

**Samples site:** Village : Khanusa, Taluka: Vijapur, District: Mehsana , Gujarat, India.

	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
1	8.38	0.77	0.66	64.24	496.3	0.84	18.8	38.19	23.32	4.14	8.6	20.3
4	8.49	0.7	0.58	51.81	460.23	0.68	19.22	27.58	23.74	2.78	9	21.7
2	7.71	0.82	0.63	62.17	441.4	0.74	17.82	24.93	22.4	1.78	9.95	19.85
5	7.68	0.87	0.55	62.17	361.24	0.78	18.76	20.16	22.32	2.78	12.8	21.2
3	7.82	0.8	0.59	74.6	356.25	0.66	21.12	13.79	24.58	3.32	11.45	20.05
6	7.96	0.6	0.62	41.45	469.94	0.64	22.58	14.85	24.84	3.48	7.85	19.75
7	8.41	0.74	0.75	60.1	457.04	0.78	19.12	29.7	24.02	3.16	9.5	19.9
8	7.81	1.35	0.28	45.59	478.4	0.72	19.8	22.81	23.8	3.06	10.15	15.25
9	8.21	1.1	1.49	62.17	275.6	0.62	20	17.5	23.2	3.12	8.15	19.65
10	8.34	1.04	0.91	53.88	462.26	1.32	18.94	22.81	23.2	2.54	10.8	20.1
11	8.24	1.1	1.03	70.46	432.61	0.8	19.22	36.6	23.42	2.96	5.25	18.95
12	8.4	0.56	0.64	60.1	472.69	0.6	19.84	13.79	22.62	3.22	3.55	20.05
13	8.16	0.7	0.59	76.68	473.24	0.88	15.72	29.17	21.54	1.74	3.65	17.55
14	8.02	0.74	0.66	51.81	441.78	0.68	19.62	14.32	24.6	2.92	3.35	18.05
15	7.98	0.73	0.69	60.1	500.96	0.56	17.2	27.58	22	2.22	5.7	19.7
16	8.58	0.62	0.8	39.37	481.97	0.6	16.96	19.1	22.12	2.4	5.25	25.45
17	8.49	0.64	0.89	74.6	459.29	0.7	19.16	13.26	24.58	2.08	4.5	22.95
18	8.08	0.68	0.72	62.17	338.51	0.54	19.44	20.16	24.02	2.72	5.35	20.55
19	8.02	0.76	0.53	47.66	212.57	0.56	15.2	19.63	16.86	2.92	2.05	18.05
20	7.93	0.65	0.66	47.66	391.82	0.56	17.88	21.75	22.62	2.68	7.05	26.05

\*=Miliequivalent

**Table No-9(B): Soil Fertility Index & Soil Test Rating**

**Samples site:** Village : Khanusa, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
L	0	16	1	0	0	0	0	0	0	0	0	0
M	11	4	14	8	2	19	0	8	0	0	0	0
H	9	0	5	12	18	1	20	12	20	20	20	20
%L	0	80	5	0	0	0	0	0	0	0	0	0
%M	55	20	70	40	10	95	0	40	0	0	0	0
%H	45	0	25	60	90	5	100	60	100	100	100	100
S.F.I.*	2.45	1.20	2.20	2.60	2.90	2.0 5	3.00	2.60	3.00	3.00	3.00	3.00
LMH** of SFI	H	L	M	H	H	M	H	H	H	H	H	H

\*= Soil Fertility Index, \*\*= Low, Medium, and High Soil Fertility Index

**CONCLUSION:-** It is Concluded from above Analysis that E.C. in Low Amount. The other parameters are sufficient in limit. pH is in High limit so it can be Neutralized by using acidic fertilizer.

**Table No-10(A): Analysis of soil sample**

**Samples site:** Village : Kolavda, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
1	8.09	1	0.85	68.39	606.65	0.38	9.52	41.37	21.9	1.56	3.05	19.35
2	8.35	1.6	0.85	55.95	645.08	0.46	15.5	32.36	16.6	1.74	1.8	16.1
3	8.31	1.29	0.68	82.89	629.15	0.58	15.1	37.13	21.1	1.76	3.1	11.7
4	8.45	0.66	0.55	64.24	550.1	0.34	16.4	37.66	23.7	1.6	2.5	19.3
5	8.2	0.47	0.55	78.75	528.69	0.56	16.2	39.78	23.2	1.72	2.85	14.35
6	8.45	0.64	1.13	51.81	599.51	0.7	16.3	39.25	24.6	2.16	3.5	20.2
7	8.31	0.56	0.72	60.1	596.21	0.5	14.6	38.19	25.4	1.8	2.3	19.9
8	8.31	0.56	0.72	60.1	596.21	0.5	14.6	38.19	25.4	1.8	2.3	19.9
9	8.63	0.46	0.64	76.68	641.23	0.44	12.2	38.19	21.2	1.48	3.8	16.9
10	8.06	0.3	0.54	53.88	523.8	0.4	14	41.37	15.9	1.12	2.45	15.35
11	8.4	1	0.76	66.32	627.51	0.6	15.4	32.89	24.9	1.62	2.7	11.6
12	8.32	0.28	1.22	58.03	567.12	0.48	16.2	39.78	27.6	2.02	5.95	12.75
13	8.06	0.5	0.78	68.39	544.61	0.44	25.6	39.78	19.5	1.46	7.5	15.3
14	8.45	0.65	0.81	55.95	511.72	0.32	14.6	33.42	22.8	1.58	6.7	13.7
15	8.15	3.9	0.79	82.89	531.43	0.38	12.2	34.48	19.2	1.48	2.5	11.6
16	8.36	1.14	0.83	64.24	586.88	0.3	14.3	35.01	20.1	1.62	2.75	12.95
17	8.5	0.5	0.73	78.75	513.53	0.74	17.2	39.78	25.1	1.78	1.75	12.85
18	8.17	1.91	1.1	62.17	514.3	0.5	18.1	32.36	25.9	2.02	5.75	15.65
19	8.12	1.87	0.83	70.46	513.86	0.5	16.7	40.84	23.4	1.86	6.45	13.95

20	8.25	0.85	0.88	74.6	632.45	0.34	15.2	31.83	23.3	1.92	1.85	12.85
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\*=Miliequivalent

**Table No-10(B): Soil Fertility Index & Soil Test Rating**

**Samples site:** Village : Kolavda, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
L	0	12	0	0	0	11	0	0	0	0	0	0
M	7	7	8	5	0	9	1	0	0	0	3	0
H	13	1	12	15	20	0	19	20	20	20	17	20
%L	0	60	0	0	0	55	0	0	0	0	0	0
%M	35	35	40	25	0	45	5	0	0	0	15	0
%H	65	5	60	75	100	0	95	100	100	100	85	100
S.F.I.*	2.65	1.45	2.60	2.75	3.00	1.45	2.95	3.00	3.00	3.00	2.85	3.00
LMH** of SFI	H	L	H	H	H	L	H	H	H	H	H	H

\*= Soil Fertility Index, \*\*= Low, Medium, and High Soil Fertility Index

**CONCLUSION:-** It is Concluded from above Analysis that E.C & Zn are in low amount for Zinc sulphate should be added for better plant and growth & Productivity. The other parameters are sufficient in limit. pH is in High limit so it can be Neutralized by using acidic fertilizer.

**Table No-11(A): Analysis of soil sample**

**Samples site:** Village : Ladol, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/ Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
1	8.15	0.82	0.41	37.3	208.62	0.14	3.58	20.2	10.9	2.72	25	10.7
2	8.04	0.99	0.34	45.59	333.79	0.12	3.44	37.1	17.8	1.94	26.5	12.9
3	7.9	1.4	0.3	62.17	340.38	0.12	3.44	35	11.8	2.16	18.7	8.7
4	7.98	1.67	0.28	58.03	446.89	0.18	5.22	24.4	14.1	1.86	18.8	8.45
5	8.3	0.47	0.32	43.52	210.27	0.06	3.52	17.5	18.5	1.94	18.6	8.15
6	7.94	1	0.3	29.01	344.77	0.08	3.66	32.4	11.5	2.24	24.9	10.9
7	8.13	0.55	0.34	24.87	294.81	0.12	3.96	23.9	12.1	2.72	14.7	6.7
8	8.25	0.97	0.31	37.3	222.89	0.04	4.62	30.2	7.68	2.46	24.9	9.8
9	8.33	0.85	0.33	35.23	247.6	0.04	6.64	26.5	14.7	2.5	17.2	8.05
10	8.32	0.66	0.63	22.8	318.97	0.1	5.16	34.5	11.1	2.54	23.1	9.5
11	8.4	1	0.37	49.74	294.26	0.02	2.92	37.7	17.1	2.2	17.4	6.95
12	8.13	1.12	0.39	41.45	158.66	0.04	5.82	17	12.1	2.24	14.8	6.3
13	8.31	1.09	0.44	55.95	230.58	0.06	6.64	38.7	9.44	2.46	27	11.8
14	7.91	1.82	0.27	62.17	344.22	0.12	4.34	18	12.3	2.54	17.3	8.1
15	8.28	0.77	0.38	53.88	309.64	0.1	3.14	38.2	16	2.5	24.8	11.6
16	8.47	0.9	0.36	76.68	247.6	0.06	2.84	29.7	11.8	2.98	20.7	8.65
17	8.26	1.25	0.37	60.1	331.6	0.04	2.76	18.6	12	2.12	22	9.9
18	8.13	0.97	0.62	47.66	167.99	0.1	3.22	22.8	13.4	1.74	28	14.6
19	8.04	1.2	0.59	35.23	312.38	0.1	3.96	15.4	12.9	2.2	19.7	8.3
20	8.31	0.93	0.57	51.81	295.91	0.08	3.8	35.5	9.28	2.16	25.7	11

\*=Miliequivalent

**Table No-11(B): Soil Fertility Index & Soil Test Rating**

**Samples site:** Village : Ladol, Taluka: Vijapur, District: Mehsana , Gujarat, India.

No	pH	E.C.	Org. Carbon (%)	Phosphorous (Kg/Hectare)	Pottash (Kg/Hectare)	Zn ppm	Fe ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
L	0	11	16	2	0	20	15	0	0	0	0	0
M	10	9	4	14	11	0	5	5	3	0	0	0
H	10	0	0	4	9	0	0	15	17	20	20	20
%L	0	55	80	10	0	100	75	0	0	0	0	0
%M	50	45	20	70	55	0	25	25	15	0	0	0
%H	50	0	0	20	45	0	0	75	85	100	100	100
S.F.I.*	2.50	1.45	1.20	2.10	2.45	1.00	1.25	2.75	2.85	3.00	3.00	3.00
LMH** of SFI	H	L	L	M	H	L	L	H	H	H	H	H

\*= Soil Fertility Index, \*\*= Low, Medium, and High Soil Fertility Index

**CONCLUSION:-** It is Concluded from above Analysis that E.C & Org. Carbon & Zn & Fe are in low amount for Farm Yard Manure & Zinc sulphate & Ferrous Ammonium Sulphate should be added for better plant and growth & Productivity. The other parameters are sufficient in limit. pH is in High limit so it can be Neutralized by using acidic fertilizer.

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