



## Analysis of Macro and Micronutrients in Soils of Vadagam Taluka in Banaskantha District

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### Abstract:

In present work an effort have been made to analyze the Soil nutrient status of selected samples of Vadagam Taluka, Banaskantha District. Five representative locations were selected for the study and 20 samples from each location and direction of area were collected. Soil is the system which supplies plant with available nutrients through the root. Physical and Chemical analysis of the soil are carried out to indicate the efficiency of soil for supplying plants with nutrients in available forms. All soil samples were analyzed for 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.

Keywords: Nutrient, Electrical conductivity, Soil, pH

### Introduction:

Healthy soil is basic component of the modern and scientific Tillage. So that it is necessary to determine the fundamental needs of soil. Application of statistical tools can provide such information and assist the interpretation of soil tested data (1-2).

**Soil testing is comprised of four steps.**

1. Collection of representative soil sample.
2. Laboratory analysis of the soil sample.
3. Interpretation of analytical results.
4. Management Interpretation of analytical recommendation based on interpreted analytical results

**Mineral nutrients are divided into two types.**

- I. Macro nutrients
- II. Micro nutrients

Macro nutrients are further decided into two parts which are Primary and secondary nutrients. Primary Nutrients are used in large quantities by plants and they include N, P, and K. secondary Nutrients including Ca, Mg and S. Micro Nutrients are needed in small amount. Then include Boron (B), copper (Cu), Iron (Fe), Manganese (Mn), Zinc (Zn) (3).

Having the right amount of Nutrients is essential for normal plant growth and reproduction as nutrient ions are removed from soil solution by plant absorption. They are replenished from served sources. Seldom is the rate of renewal for an essential element from untreated soil fast enough to achieve maximum crop production to Augment this removal fertilizer are usually applied (4).

Aim for this research paper is to introduce the plant nutrients and analysis methods. there are nutrients in this research paper is N, K, P, Ca, Mg, S. conductivity of soil is given by the EC and acidic, basicity or neutrality is finding by pH method.

Soil pH is one of the most important soil properties that affected the availability of nutrients and hence it was also measured in journal macro nutrients tend to be less available in soils with low pH while micro nutrients tend to be less available in soils with high pH(5).

Total soluble SALTS are estimated from electrical conductivity of aqueous soil extract. Standard value of EC in soil normal less than 0.8ds/m critical for salt sensitive crops critical for salt crops 1.6 up to 2.5ds/m. Injurious the most crops less than 2.5ds/m. The EC value 4 to 1.8(6).

The fertility of soil depends on the concentration of N P, K, organic and inorganic nutrients and water.

1. Nitrogen is requiring for growth of plant.
2. Phosphorus is act as energy storage which is minor nutrient in plant nuclei.
3. Potassium is found in its minerals and it is require for activation (7-8).

Calcium which is part of plant cell wall structure provides for normal transport and retention of other elements as well as the strength in the plant. It is also effect of alkali salts and organic acids within a plant (9). Calcium and magnesium are available as exchangeable cat ions. The amount available of both elements is importantly related to mineral weathering and degree of leaching (10).

Sulphate is one of the most commonly monitor ate anion in soil and natural water in soil extracts. Sulphate is measure of available sulphur status (11).

### 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 dithiocarbomate, 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 nutrition was analyzed on Double beam atomic absorption spectrophotometer (Elico Model No-SL 194).

### METHOD OF ANALYSIS:-

#### (1) 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.

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	55.5
5	2.5ml	25ppm	66.5
6	3.0ml	30ppm	77
7	4.0ml	40ppm	99
	Total	140ppm	385.5

### Calculation

$$\begin{aligned} 1 \text{ Reading} &= \text{Total Solution of ppm} / \text{Total Reading} \\ &= 140 / 385.5 \\ &= 0.363 \end{aligned}$$

$$\begin{aligned} 1 \text{ Gram Soil} &= R \times 0.363 \times 5 \text{ Microgram K} / \text{Gram Soil} \quad (0.363 \text{ Graph Factor}) \\ R &= \text{Flame Photometer Reading of sample} \end{aligned}$$

### **K**

$$\text{Kg/Hectare} = R \times 0.363 \times 5 \times 2.24 \quad (2.24 = \text{Factor in K Hectare})$$

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

$$\begin{aligned} \text{Kg/Hectare} &= R \times 0.363 \times 5 \times 2.24 \times 1.20 \quad (1.20 = \text{Factor in K}_2\text{O} \\ &\text{Hectare}) \\ &= R \times 4.878 \end{aligned}$$

### **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.

### **(2) 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. Immersed electrode in above suspension solution and note the reading.

### **(3) 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. Immersed electrode in above suspension solution and note the reading.

### **(4) 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.

**(5) 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.

**(6) 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.

Sr. No	ml of sucrose solution diluted in potassium dichromate	Amount of sucrose	O.D.
1	0 (blank)	-----	0
2	1	0.005 g	28
3	2	0.010 g	66
4	3	0.015 g	95
5	4	0.020 g	126
6	5	0.025 g	154
7	6	0.030 g	183
	Total	0.105 g	652

**Calculation:-**

**1 Reading**

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

1 Reading Carbon value:

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

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

**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.

**(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.

**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	21
3	2 ml = 4 ppm	5 ml	5 ml	1 ml	38
4	3 ml = 6 ppm	5 ml	5 ml	1 ml	56
5	4 ml = 8 ppm	5 ml	5 ml	1 ml	80
6	5 ml = 10 ppm	5 ml	5 ml	1 ml	101
7	10 ml = 20 ppm	5 ml	5 ml	1 ml	199
	Total = 50 ppm				495

**Calculation**

1 Reading

$$\begin{aligned}
 &= \text{Total Solution of ppm} / \text{Total Reading} \\
 &= 50 / 495 \\
 &= 0.101 \\
 &0.1010 \text{ Microgram P (Graph Factor)}
 \end{aligned}$$

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) 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.

Sr. No.	Working standard sulphur solution in ml	ppm	O.D.
1	0	0	0
2	1	1	10
3	2	2	21
4	3	3	30
5	4	4	41
6	5	5	54
7	6	6	68
8	7	7	85
9	8	8	104
10	10	10	129
	Total ppm	46	Total: 542

**Calculation:-**

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

$$1 \text{ Reading} = 46/542$$

$$=0.08$$

Sulphar ppm or mg/kg

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

$$\text{Sample Reading} \times 0.084871 \times 50 \times 25/200$$

**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.

**(9) 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.

**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.

**Critical Limits of Nutrients:-**

Sr.No	Parameters	Unit	Critical Limits		
			Low	Medium	High
1	pH	-----	<6.5	6.5-8.2	>8.2
2	Electric Conductance	-----	<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

**Calculation of soil fertility Index:**

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

**Calculation of Low, Medium, High rating of soil fertility Index:**

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

**Samples site:** Village : Kodram, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	8.28	0.15	0.71	66.32	191.42	0.24	5.84	7.96	18.48	0.62	1.7	8.7
2	8.46	0.17	0.76	31.09	257.01	0.3	3.84	29.17	11.04	0.44	3.3	9.5
3	8.54	0.17	0.72	29.01	211.50	0.16	3.3	28.11	6.88	0.48	2.3	8.6
4	8.56	0.15	0.65	31.09	178.03	0.14	2.72	18.04	6.82	0.5	6.55	12.25
5	8.21	0.18	0.83	29.01	262.37	0.16	3.74	13.26	12.28	0.4	1.5	11.3
6	8.48	0.16	0.76	64.24	274.41	0.16	3.3	19.63	12.62	0.3	2.3	12.4
7	8.53	0.21	0.74	43.52	148.58	0.12	2.78	20.16	6.76	0.38	5.55	10.85
8	8.31	0.17	0.64	29.01	144.57	0.16	3.2	16.44	7.88	0.44	3.75	9.65
9	8.32	0.17	0.57	45.59	123.15	0.14	3.98	15.91	8.92	0.44	2.35	8.95
10	8.51	0.20	0.72	26.94	167.33	0.36	3.34	13.79	12.4	0.42	3.85	9.25
11	8.22	0.19	0.76	31.09	231.58	0.26	3.34	12.20	11.04	0.4	2.6	11.9
12	8.42	0.17	0.68	43.52	202.13	0.14	3.02	19.10	7.76	0.5	2.25	7.55
13	8.38	0.59	0.58	41.45	560.87	0.38	3.02	25.46	14.3	0.64	2.2	7.3
14	8.18	0.21	0.64	26.94	183.39	0.2	3.02	18.04	10.02	0.44	4.75	11.15
15	8.42	0.15	0.87	64.24	202.13	0.24	2.9	23.34	9.98	0.38	3.25	8.75
16	8.20	0.17	0.80	31.09	235.59	0.14	2.82	23.34	12.86	0.42	3.65	9.45
17	8.48	0.18	0.71	41.45	155.28	0.14	2.3	23.87	6.98	0.4	4.15	10.05
18	8.26	0.59	0.62	37.30	548.83	0.38	3.98	31.83	14.98	0.62	3.15	9.15
19	8.25	0.21	1.09	66.32	239.61	0.2	3.48	19.10	14.06	0.48	1.65	8.45
20	8.51	0.16	0.77	64.24	161.97	0.22	3.7	16.97	11.38	0.4	1.6	6.9

\*=Miliequivalent

**Soil Fertility Index & Soil Test Rating:**

**Samples site:**

Village : Kodram, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	0	0	3	20	19	1	0	0	0	0
M	2	0	12	15	15	0	1	11	8	7	4	0
H	18	0	8	5	2	0	0	8	12	13	16	20
%L	0	100	0	0	15	100	95	5	0	0	0	0
%M	10	0	60	75	75	0	5	55	40	35	20	0
%H	90	0	40	25	10	0	0	40	60	65	80	100
S.F.I.*	2.90	1.00	2.40	2.25	1.95	1.00	1.05	2.35	2.60	2.65	2.80	3.00
LMH** of SFI	H	L	H	M	M	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 & Fe and Mn are in low amount for ferrous ammonium sulphate & Manganese Sulphate should be added for better plant and growth & Productivity. The other parameters are in sufficient in limit. pH is in medium limit so it can be Neutralized by using acidic fertilizer.

**Samples site:**

Village : Vadagam, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	0.11	0.26	78.75	248.98	0.26	3.58	9.02	6.38	0.44	1.20	3.8
2	8.85	0.12	0.23	64.24	243.63	0.06	3.44	126.78	5.58	0.36	1.80	4.2
3	8.40	0.46	0.49	49.74	261.03	0.02	3.44	20.69	5.34	0.44	1.00	4
4	8.65	0.21	0.83	70.46	307.88	0.36	5.22	14.85	12.18	0.5	2.00	4
5	8.75	0.19	0.39	62.17	278.43	0.1	3.52	20.16	6.18	0.36	1.25	4.25
6	8.40	0.11	0.40	72.53	273.07	0.06	3.66	19.63	9.48	0.3	2.80	3.7
7	8.25	0.31	0.30	64.24	266.38	0.06	3.96	25.46	9.48	0.38	1.30	4
8	8.82	0.16	1.33	43.52	277.09	0.32	4.62	18.57	10.02	0.38	3.30	3
9	8.50	0.11	0.39	29.01	315.91	0.12	6.64	28.11	15.64	0.4	2.25	5.75
10	8.12	0.22	0.51	47.66	287.80	0.1	5.16	24.93	10.78	0.34	2.50	3.5
11	8.38	0.13	0.42	64.24	306.54	0.08	2.92	12.20	6.96	0.16	1.50	5.1
12	8.46	0.15	0.53	49.74	303.86	0.2	5.82	27.05	14.46	0.48	1.65	5.25
13	8.32	0.12	0.43	45.59	286.46	0.14	6.64	27.05	17.1	0.5	0.75	3.55
14	8.78	0.11	0.43	43.52	307.88	0.14	4.34	27.58	15.36	0.58	0.55	3.75
15	8.41	0.17	0.59	31.09	302.52	0.12	3.14	25.46	8.44	0.4	1.10	4.2
16	8.68	0.16	0.76	29.01	269.06	0.2	2.84	19.63	13.98	0.44	0.40	3.5
17	8.76	0.12	0.60	41.45	257.01	0.14	2.76	15.91	11.98	0.36	1.25	4.15
18	8.75	0.18	0.41	43.52	274.41	0.1	3.22	20.69	9.66	0.46	1.60	4.9
19	8.48	0.10	0.44	49.74	257.01	0.26	3.96	25.46	16.92	0.56	0.45	4.15
20	8.50	0.17	0.35	47.66	342.68	0.22	3.8	16.97	16.06	0.52	0.70	4.9

\*=Miliequivalent

**Soil Fertility Index & Soil Test Rating:**

**Samples site:**

Village : Vadagam, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	14	0	0	20	15	1	0	1	5	0
M	1	0	3	13	13	0	5	7	9	9	11	1
H	19	0	3	7	7	0	0	12	11	10	4	19
%L	0	100	70	0	0	100	75	5	0	5	25	0
%M	5	0	15	65	65	0	25	35	45	45	55	5
%H	95	0	15	35	35	0	0	60	55	50	20	95
S.F.I.*	2.95	1.00	1.45	2.35	2.35	1.00	1.25	2.55	2.55	2.45	1.95	2.95
LMH** of SFI	H	L	L	H	H	L	L	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 & Org. Carbon & Fe and Mn are in low amount for Farm Yard manuar & ferrous ammonium sulphate & Manganese 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.

**Samples site:**

Village : Varvadiya, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	8.46	0.15	0.83	64.24	306.54	0.42	7.96	21.75	24.76	0.96	0.9	11.75
2	8.58	0.19	0.87	89.11	262.37	0.7	7.4	15.91	25.2	1.02	0.65	9.85
3	8.49	0.24	0.90	43.52	318.59	0.64	7.82	20.16	26.14	0.88	0.75	10.25
4	8.45	0.23	0.80	49.74	330.63	0.62	6.94	19.63	26.66	1	1.15	9.25
5	8.68	0.14	0.87	84.97	326.62	0.6	6.4	23.34	20	0.94	0.55	9.95
6	8.30	0.14	0.59	93.26	224.88	1.18	8.88	23.87	19.7	0.94	2.25	7.15
7	8.68	0.15	0.83	89.11	318.59	0.62	6.46	19.63	26.66	0.9	1.6	10.1
8	8.10	0.14	0.54	80.82	211.50	1.38	9.98	16.97	22.76	1.16	0.9	9.4
9	8.52	0.12	0.79	64.24	360.08	0.66	9.24	24.93	29.36	0.96	1.55	9.55
10	8.11	0.11	0.60	91.18	222.21	1.12	7.14	15.38	19.7	1.06	4	5.7
11	8.46	0.24	0.76	84.97	373.47	1.08	6.72	14.32	26.32	0.76	1.45	9.15
12	8.48	0.15	0.66	87.04	315.91	0.86	6.8	14.85	24.76	0.88	2	9.4

13	8.66	0.12	0.75	93.26	307.88	0.76	5.94	16.97	25.36	0.84	2.55	9.65
14	8.66	0.23	0.61	24.87	352.05	0.58	6.66	30.24	22.54	0.78	3	10
15	8.24	0.13	0.57	89.11	220.87	1.02	7.48	22.81	17.52	0.82	1.9	8.1
16	8.10	0.22	0.62	47.66	164.65	0.98	5.3	12.20	20.16	0.7	0.75	6.25
17	8.25	0.12	0.78	93.26	311.89	0.9	6.34	14.85	22.34	0.84	2.25	7.25
18	8.22	0.17	0.95	66.32	306.54	0.6	7.28	25.99	24.1	0.78	3.25	6.75
19	8.25	0.15	0.76	76.68	315.91	0.92	7.68	16.97	25.36	0.84	3	6.5
20	8.20	0.17	1.07	84.97	338.67	0.94	8.04	19.10	26.82	0.88	3	6.5

\*=Miliequivalent

### Soil Fertility Index & Soil Test Rating:

#### Samples site:

Village : Varvadiya, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	0	1	0	1	0	0	0	0	6	0
M	4	0	8	3	6	14	20	12	0	0	6	0
H	16	0	12	16	14	5	0	8	20	20	8	20
%L	0	100	0	5	0	5	0	0	0	0	30	0
%M	20	0	40	15	30	70	100	60	0	0	30	0
%H	80	0	60	80	70	25	0	40	100	100	40	100
S.F.I.*	2.80	1.00	2.60	2.75	2.70	2.20	2.00	2.40	3.00	3.00	2.10	3.00
LMH** of SFI	H	L	H	H	H	M	M	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 & Org.Carbon & Fe and Mn are in low amount for Farm Yard manuar & ferrous ammonium sulphate & Manganese 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.

**Samples site:**

Village: Sherpur, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	8.26	0.17	0.59	24.87	199.45	0.66	5.24	30.77	11.48	0.64	2.4	6.6
2	7.83	0.31	0.83	26.94	733.55	0.7	3.86	42.97	12.58	0.72	0.8	7.7
3	8.80	0.17	0.65	29.01	374.81	0.58	4.4	36.07	11.66	0.74	1.1	6.3
4	8.10	0.34	1.14	31.09	750.95	0.48	2.62	38.72	11.66	0.76	0.75	5.95
5	8.16	0.25	1.09	66.32	386.86	0.98	3.56	33.42	9.88	0.86	0.35	6.65
6	8.40	0.27	0.91	26.94	833.95	0.54	2.82	23.34	12.84	0.54	0.9	4.9
7	8.60	0.32	1.02	29.01	492.60	1.02	4.86	42.44	8.42	0.78	0.45	6.55
8	8.50	0.25	0.53	70.46	401.58	0.72	3.44	29.70	20.06	1.54	1	6.3
9	8.80	0.28	0.55	26.94	171.34	0.5	3.26	24.93	5.5	0.48	1.1	8.4
10	8.75	0.52	0.58	41.45	277.09	0.36	2.4	40.84	7.7	0.5	0.45	7.85
11	8.96	0.42	0.45	29.01	286.46	0.2	2.12	38.72	5.08	0.34	0.85	7.15
12	8.75	0.44	0.46	26.94	290.48	0.22	2.78	34.48	4.98	0.38	1.35	7.45
13	8.95	0.25	0.43	31.09	228.90	0.16	3.34	27.05	4.8	0.44	2.45	5.65
14	8.68	0.22	1.22	64.24	376.15	0.32	2.44	18.57	11.52	0.94	0.9	7.1
15	8.55	0.13	0.46	29.01	160.63	0.04	3.52	18.04	6.34	0.52	3	6
16	8.28	0.21	0.39	22.80	266.38	0.16	2.7	28.64	4.68	0.4	2.3	7.7
17	8.71	0.22	1.16	43.52	331.97	0.66	2.9	29.70	6.96	0.76	0.65	4.95
18	8.26	0.27	1.31	87.04	586.31	0.26	2.44	35.54	9.94	0.84	1.55	5.65
19	8.69	0.28	0.60	26.94	218.19	0.1	2.62	43.50	4.04	0.36	1.1	6.3
20	8.20	0.27	1.03	66.32	511.35	0.74	3.14	16.97	8.48	0.82	1.85	6.65

\*= Miliequivalent

**Soil Fertility Index & Soil Test Rating:**

**Samples site:**

Village: Sherpur, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	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	5	2	0	10	19	0	4	0	9	0
M	4	0	6	13	9	9	1	3	9	4	7	0
H	16	0	9	5	11	1	0	17	7	16	4	20
%L	0	100	25	10	0	50	95	0	20	0	45	0
%M	20	0	30	65	45	45	5	15	45	20	35	0
%H	80	0	45	25	55	5	0	85	35	80	20	100
S.F.I.*	2.80	1.00	2.20	2.15	2.55	1.55	1.05	2.85	2.15	2.80	1.75	3.00
LMH** of SFI	H	L	M	M	H	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 & Fe and Mn are in low amount for ferrous ammonium sulphate & Manganese 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 like Phosphorous Fertilizer.

**Samples site:**

Village: Ambetha, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	Org. Carbon (%)	Phosphorus (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	8.54	0.10	0.47	43.52	250.32	0.66	3.36	23.87	11.26	0.56	2.75	3.25
2	8.28	0.10	0.30	66.32	297.17	0.14	2.08	45.62	8.02	0.48	1.00	4.5
3	7.43	0.09	0.24	47.66	289.14	0.18	3.96	50.92	12.78	0.56	1.50	4.5
4	8.18	0.28	0.32	29.01	289.14	0.2	3.66	56.76	14.92	0.62	3.25	3.75
5	8.42	0.11	0.45	41.45	310.56	0.32	6.86	38.19	14.82	0.6	2.75	5.75
6	8.45	0.09	0.53	22.80	313.23	0.3	4.1	46.15	13.3	0.58	4.25	4.25
7	8.31	0.11	0.29	29.01	306.54	0.22	4.78	55.70	14.16	0.48	2.95	4.25
8	8.44	0.10	0.76	51.81	322.60	0.24	5.68	46.15	13.8	0.56	4.45	7.55
9	8.92	0.15	0.87	68.39	345.36	0.18	3.58	20.69	9.4	0.56	3.05	7.15
10	8.88	0.15	0.57	45.59	319.93	0.4	3.66	14.85	0.12	0.58	2.10	7.3
11	8.27	0.30	0.44	43.52	270.40	0.28	4.34	13.26	6.76	0.56	0.75	3.75
12	8.47	0.31	0.56	41.45	275.75	0.36	3.66	20.16	5.86	0.62	1.70	3.8
13	8.37	0.21	0.32	29.01	295.83	0.46	3.88	22.28	9.4	0.6	0.85	3.65
14	8.84	0.33	0.62	43.52	380.16	0.32	3.36	18.57	5.24	0.58	1.05	4.55
15	8.12	0.23	0.25	70.46	242.29	0.24	3.14	26.52	4.36	0.5	0.85	4.85
16	8.55	0.16	0.89	64.24	357.41	0.24	3.36	11.67	7.28	0.6	2.05	4.15
17	9.47	0.15	0.28	41.45	327.96	0.34	3.22	25.99	7.66	0.64	1.25	6.35
18	8.65	0.13	0.32	22.80	337.33	0.22	3.88	14.32	5.38	0.68	1.05	3.55
19	8.87	0.12	0.26	47.66	236.93	0.36	3.58	23.87	4.92	0.6	0.80	5.8
20	8.85	0.16	0.28	72.53	216.85	0.16	3.14	17.50	4.22	0.5	2.25	4.45

\*=Miliequivalent

**Soil Fertility Index:**



**Samples site & Soil Test Rating:**

Village: Ambetha, Taluka: Vadgam, District: Banashkantha, Gujarat, India.

Sample No.	pH	EC	Org. Carbon (%)	Phosphorous (Kg/Hectare)	Potash (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	13	2	0	19	18	0	4	0	4	0
M	3	0	4	13	10	1	2	6	9	0	6	0
H	17	0	3	5	10	0	0	14	7	20	10	20
%L	0	100	65	10	0	95	90	0	20	0	20	0
%M	15	0	20	65	50	5	10	30	45	0	30	0
%H	85	0	15	25	50	0	0	70	35	100	50	100
S.F.I.*	2.85	1.00	1.50	2.15	2.50	1.05	1.10	2.70	2.15	3.00	2.30	3.00
LMH** of SFI	H	L	L	M	H	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 & Org.Carbon & Fe and Mn are in low amount for ferrous ammonium sulphate & Manganese 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 like Phosphorous Fertilizer.

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