Assessment of Macro and Micronutrients in Soils from Sami Taluka, Dist. Patan Area, Gujarat, India

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Abstract:

In achieving better crop yield the farmers should be made aware about the status of soil constituents, chemistry of water available, nutrient supply to the crop, climatic conditions etc. To study the nutrients status of soil of sami taluka, district patan, five representative locations were selected and 20 samples from each location and direction of area were collected and the analytical results were expected to be representative of the entire field. The different physical parameters were analyzed in laboratory are pH, Electrical conductivity, Organic carbon, available potash, phosphorous and sulphur. The micro elements such as manganese, zinc, copper and iron were estimated by Atomic Absorption Spectroscopy while calcium and magnesium were estimated by volumetric titration. Low, medium & high range of above parameter also calculated from analysis data.

Keywords: Soil, pH, Electrical conductivity, Spectroscopy

Introduction:

The term "soil testing" refers to the full range of chemical, physical and biological tests that may be carried out on a submitted sample of soil, though in the present context only nutritional aspects will be considered. Soil testing has a long history, and has contributed significantly to the development of modern scientifically-based production systems. More recently, it has become an important, but all too often a misused, tool for turf producers and turf managers. The present paper explains the principles on which good soil testing is based, how the results should be interpreted, and what can realistically be expected of a soil test in turf situations. Soil is a one type of diverse complex that can be known as mixture of minerals and organic material, which are capable of supporting plant life [1-4].

The soil test aimed at soil fertility evaluation with resulting fertilizer recommendation is, therefore, the actual connecting link between the agronomic research and its practical application to the farmers' field. 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. Soils vary tremendously in their ability to supply nutrients to plants. When a soil has low ability to provide plants with one or more nutrients, it is usually the practice to apply these nutrients to the soil in the form of fertilizers in order to increase crop yields. When farmers invest money in costly fertilizers, it is logical that they are interested in using fertilizers on only those areas where yields will be increased. Applying chemical fertilizers without soil tests is like buying a box from a shop without knowing what it contains! This means that if fertilizers are to be applied in a rational manner, a soil test has to be carried out. T. N. Nath

studied [5] on the status of micro nutrients [Mn, Fe, Cu, Zn] in plantation. Agbaire et al. [6] have studied on physiochemical properties and micro nutrient status of farmland soil in abarka, Nigeria.

The major purpose of soil tests is to estimate the ability of a soil to supply the various Nutrients under specific conditions. With regard to soil tests, a clear distinction should be made between tests which can be interpreted easily in agricultural terms, such as gypsum requirements, pH and electrical conductivity measurements for salinity/sodicity purposes, and other tests for available plant nutrients in the soil. The latter tests are mainly centred on N, P and K. The values of these tests do not show fertilizer requirements directly. Classifying soil tests values as "high", "medium" and "low" does not indicate how much fertilizer to be applied to get the desired and economical yield increase. To make sound fertilizer recommendations or "site-specific recommendations", soil tests for available plant nutrients must be calibrated with crop response. Unfortunately, soil test interpretation worked out in one area is usually not valid for another different set of agro ecological conditions. Soil test calibrations which are used or developed in one country (say a developed country) cannot be transferred to another country. New calibrations must be done under local conditions if soil tests are to be used to refine a generalized fertilizer recommendation. Many researchers have studied on soil fertility of various soil samples [7-12].

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 arepresentative 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 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 Nutrients was analyzed on Double beam atomic absorption spectrophotometer (Elico Model No-SL 194).

METHOD OF ANALYSIS:-

(1) 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.

(2) 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-1: 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	23
3	2 ml = 4 ppm	5 ml	5 ml	1 ml	35
4	3 ml = 6 ppm	5 ml	5 ml	1 ml	55
5	4 ml = 8 ppm	5 ml	5 ml	1 ml	89
6	5 ml = 10 ppm	5 ml	5 ml	1 ml	102
7	10 ml = 20 ppm	5 ml	5 ml	1 ml	196
	Total = 50 ppm				500

Calculation

1 Reading

= Total Solution of ppm / Total Reading
=50 / 500
= 0.100

0.1010 Microgram P (Graph Factor)

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_2O_5 Kg/ Hectare = R X 0.1010 X 4 x 2.24 X 2.29 (2.29 = Factor in 'P_2O_5 ' Hectare)

P_2O_5 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.

(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 ^{0}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.

(4) 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 ^{0}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.

(5) 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-2: 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	36
3	1.5ml	15ppm	45.5
4	2.0ml	20ppm	53.5
5	2.5ml	25ppm	62.5
6	3.0ml	30ppm	76
7	4.0ml	40ppm	99
	Total	140ppm	372.5

Calculation:

1 Reading = Total Solution of ppm / Total Reading
=140 / 372.5
= 0.376

1 Gram Soil = R X 0.376 X 5 Microgram K / Gram Soil (0.376 Graph Factor)
R= Flame Photometer Reading of sample

K
Kg/Hectare = R X 0.376 X 5 X 2.24 (2.24 = Factor in **K** Hectare)

K_2O
Kg/Hectare = R X 0.376 X 5 X 2.24 X 1.20 (1.20 = Factor in **K_2O** Hectare)
= R X 5.053

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.

(6) 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.

(7) 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-3: 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	25
3	2	0.010 g	69
4	3	0.015 g	93
5	4	0.020 g	129
6	5	0.025 g	156
7	6	0.030 g	181
	Total	0.105 g	653

Calculation:-

1 Reading

1 Reading = Total Amount of Sucrose / Total Reading
= 0.000160796
= 0.000161043 g Sucrose

1 Reading Carbon value:
0.00006753
0.00006764 gram organic carbon

1 Reading Graph Factor Value = 0.000067638 X 100
= 0.0067638

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.

(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.

Table No-4: Reading for Standard Graph of Sulphur

Sr. No.	Working standard sulphur solution in ml	Ppm	O.D.
1	0	0	0
2	1	1	50
3	2	2	22
4	3	3	29
5	4	4	43
6	5	5	52
7	6	6	65
8	7	7	89
9	8	8	102
10	10	10	125
	Total ppm	46	Total: 542

Calculation:-

1 Reading = Total ppm of Sulphar/Total reading

1 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

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.

(9) 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 multiped with factor 2.0.

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:

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

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 : Palipur, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
1	8.33	2.3	0.56	43.52	405.16	0.28	8.24	25.5	14	1	1.3	5
2	8.46	2.6	0.51	37.3	370.58	0.44	8.64	28.1	16	1.4	1.1	7
3	8.7	2.1	0.64	66.32	425.48	0.38	8.92	31.3	16	1.16	1.8	7
4	8.37	2.4	0.7	58.03	414.52	0.4	10.1	34	15	1.08	1.3	8
5	8.29	1.9	0.45	78.75	373.32	0.4	9.98	37.7	18	1.16	2.3	6
6	8.46	1.3	0.41	51.81	498.49	0.36	8.8	19.6	18	1.28	1.1	5
7	8.12	2.58	0.52	60.1	557.24	1.9	12	38.7	22	2.26	5.4	6
8	8.16	1.9	0.57	18.65	402.42	0.7	8.28	23.3	20	1.68	3.6	11
9	8.18	2.2	0.62	68.39	387.05	3.3	9.14	39.8	20	1.84	2.7	9
10	8.16	2.5	0.51	64.24	413.4	3.18	9.2	18.6	19	1.92	2.8	9
11	8.24	2.1	0.55	64.24	422.73	1.56	8.46	23.3	19	1.72	1.9	11
12	8.29	2.4	0.86	14.51	354.11	0.84	8	23.9	19	1.76	4.8	8
13	8.19	2.7	0.73	55.95	403.52	3.24	9.08	30.2	19	1.68	3.9	8
14	8.37	2.3	0.67	66.32	438.1	1.08	8	19.6	18	1.54	1	9
15	8.44	2.5	0.53	84.97	410.65	0.64	8.28	21.2	19	1.58	3	9
16	8.19	0.6	0.58	66.32	436.46	0.62	8.06	24.9	19	1.58	2.5	10
17	8.52	2.4	0.49	70.46	323.91	0.5	964	29.2	18	1.36	3.2	10
18	8.3	2.5	0.34	41.45	441.95	0.66	8.98	32.4	20	1.48	0.7	4
19	8.46	2.6	0.53	55.95	400.77	0.44	13.8	30.8	20	1.92	1.6	10
20	8.15	2.4	0.57	64.24	387.05	2.64	9.8	24.9	20	1.92	2.1	9

***=Miliequivalent**

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

Samples site:

Village : Palipur, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
L	0	1	4	2	0	7	0	0	0	0	1	0
M	7	19	15	7	0	6	16	3	0	0	8	0
H	13	0	1	11	20	7	4	17	20	20	11	20
%L	0	5	20	10	0	35	0	0	0	0	5	0
%M	35	95	75	35	0	30	80	15	0	0	40	0
%H	65	0	5	55	100	35	20	85	100	100	55	100
S.F.I.*	2.65	1.95	1.85	2.45	3.00	2.00	2.20	2.85	3.00	3.00	2.50	3.00
LMH** of SFI	H	M	M	H	H	M	M	H	H	H	H	H

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

CONCLUSION:-

It is concluded from about analysis that, All parameters are in sufficient limit so no needed for treatments. 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 : Sipur, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
1	8.27	2.2	0.39	37.3	232.23	0.48	11.2	22.28	11.9	0.7	1.6	6.8
2	8.33	1.9	0.43	26.94	426.02	0.5	10.9	30.24	14.8	0.88	3.5	11.7
3	8.37	1.9	0.46	43.52	361.24	0.5	12	39.25	16.7	1	5.65	13.25
4	8.43	2.2	0.19	72.53	306.89	0.4	12.4	31.83	16	0.88	2.95	3.95
5	8.51	2.4	0.45	84.97	386.5	0.58	14	20.16	18.1	1.1	0.95	7.45
6	8.57	1.4	0.23	47.66	292.07	0.44	12.1	31.83	16	0.8	1.75	4.05
7	8.12	2.2	0.38	76.68	429.32	0.46	14.3	30.77	17.4	0.98	3.75	10.05
8	8.19	2.5	0.26	80.82	369.48	0.54	12.8	37.66	15.1	0.68	1.75	3.75
9	8.26	2.4	0.4	78.75	293.72	0.46	13.2	32.89	18.5	0.98	2.35	9.65
10	8.28	2.4	0.62	31.09	408.46	0.44	14.9	15.91	19.3	1.04	2.25	5.25
11	8.35	2.5	0.5	60.1	326.66	0.3	12.4	37.13	15.7	0.82	2.7	11
12	8.37	2.1	0.55	12.43	557.24	1.38	18.6	19.1	23.6	2.04	1.8	14.9
13	8.44	2.1	0.6	39.37	403.52	0.64	14.3	21.22	19.6	1.2	1.85	13.05
14	8.41	2.4	0.51	29.01	323.91	0.56	14.7	23.87	19.5	1.04	1.35	5.75
15	8.12	1.9	0.42	64.24	343.13	0.6	13.4	35.01	15.2	1.42	1.35	7.55
16	8.18	2.6	0.53	51.81	316.22	0.78	23.6	36.07	22.4	1.22	0.8	10.9
17	8.14	0.8	0.3	29.01	339.28	0.62	14.9	21.75	18.5	1.1	0.65	8.35
18	8.24	2.4	0.6	37.3	354.11	0.7	13.8	28.11	16.8	0.98	3.1	14
19	8.24	2.1	0.51	43.52	391.44	0.86	14.3	21.22	19.4	1.16	2.75	12.05
20	8.37	2.4	0.56	18.65	355.75	0.4	11	37.13	15.7	0.82	2.2	11.4

***=Miliequivalent**

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

Samples site: Village : Sipur , Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
L	0	1	12	2	0	8	0	0	0	0	3	0
M	5	19	8	11	3	11	0	2	0	0	7	0
H	15	0	0	7	17	1	20	17	20	20	10	20
%L	0	5	60	10	0	40	0	0	0	0	15	0
%M	25	95	40	55	15	55	0	10	0	0	35	0
%H	75	0	0	35	85	5	100	85	100	100	50	100
S.F.I.*	2.75	1.95	1.40	2.25	2.85	1.65	3.00	2.75	3.00	3.00	2.35	3.00
LMH** of SFI	H	M	L	M	H	L	H	H	H	H	H	H

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

CONCLUSION:-

It is concluded form above analysis that Organic carbon & Zn are in low in amount. Farm yard manure & Zinc sulphate should be added for better plant growth & productivity. The other parameters are sufficient. 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 : Panchasar, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
1	8.42	0.24	0.44	53.88	317.25	0.56	13.9	34.48	22.1	2.06	2.05	8.35
2	8.36	0.25	0.38	51.81	222.21	0.34	13.4	36.6	26.1	2.08	1.7	7.6
3	8.27	0.23	0.37	76.68	374.81	0.32	12.4	36.6	20.8	1.82	0.45	7.55
4	8.57	0.17	0.46	66.32	381.5	0.28	12.1	42.44	23	1.76	1.65	5.65
5	8.4	0.27	0.28	58.03	222.21	0.26	13.4	35.01	21.5	1.98	0.9	9.1
6	7.78	0.6	0.42	68.39	440.4	0.32	14	40.31	23.5	2.08	2.05	6.35
7	8.13	0.92	0.43	55.95	500.64	0.38	13.6	34.48	24.5	1.94	2	7.5
8	8.4	0.29	0.39	82.89	561.63	0.54	12.7	39.25	19.9	1.68	1.3	4.9
9	8.32	0.35	0.53	64.24	306.54	0.66	14	32.89	28.8	2.72	1.35	5.65
10	8.37	0.3	0.28	78.75	409.61	0.38	12.2	32.36	23.9	2.22	0.3	8.2
11	8.43	0.24	0.37	51.81	453.79	0.3	14.1	39.25	11.2	2.56	1.35	8.95
12	8.25	0.27	0.31	60.1	600.61	0.34	15.1	40.84	25.3	2.16	1.2	5.9
13	8.37	0.16	0.29	72.53	335.99	0.56	14.1	35.54	21.1	2	1.55	6.25
14	8.36	0.14	0.14	76.68	269.06	0.64	14.4	36.07	24.6	2.4	1.8	7.1
15	8.31	0.21	0.24	53.88	455.12	0.54	14.6	40.31	26.3	2.48	1.25	6.05
16	8.17	0.31	0.32	66.32	223.55	1.16	14.1	41.37	16.7	1.02	1	4.3
17	8.35	0.19	0.36	58.03	440.4	0.58	13.6	39.25	18.8	1.7	1.1	5.9
18	7.89	0.91	0.34	68.39	472.53	0.42	12.6	37.66	26.5	2.18	1.4	6.2
19	8.43	0.21	0.41	55.95	409.61	0.42	13.6	41.9	26.7	2.18	1.05	7.45
20	7.8	0.39	0.36	82.89	542.13	0.26	12.3	31.83	17.6	1.92	2.6	8.1

***=Miliequivalent**

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

Samples site: Village : Panchasar, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
L	0	20	19	0	0	12	0	0	0	0	3	0
M	5	0	1	8	4	7	0	0	0	0	14	0
H	15	0	0	12	16	1	20	20	20	20	3	20
%L	0	100	95	0	0	60	0	0	0	0	15	0
%M	25	0	5	40	20	35	0	0	0	0	70	0
%H	75	0	0	60	80	5	100	100	100	100	15	100
S.F.I.*	2.75	1.00	1.05	2.60	2.80	1.45	3.00	3.00	3.00	3.00	2.00	3.00
LMH** of SFI	H	L	L	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. & Organic Carbon & Zn are in low amount. Farm yard manure & Zinc Sulphate should be added for better plant growth & productivity. The other parameters are in sufficient. pH is in high in limit, so it can be neutralized by using acidic fertilizer.

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

Samples site: Village : Tuvad, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
1	8.5	0.24	0.19	37.3	349.33	0.52	7.18	21.78	11.4	3.06	2	12.3
2	8.67	0.32	0.17	16.58	390.67	0.48	7.24	24.93	11.3	1.6	2.05	12.05
3	8.77	0.28	0.21	43.52	397.48	0.46	6.56	32.89	10.64	1.3	1.8	14.8
4	8.55	0.27	0.15	22.8	397.48	0.46	5.6	37.13	8.52	1.14	2.45	13.15
5	8.14	0.36	0.26	35.23	342.03	0.42	6.18	32.89	7.88	1.24	2	14.7
6	8.45	0.74	0.32	31.09	231.13	0.7	6.98	36.07	7.68	1.66	1.5	15.3
7	8.02	0.19	0.3	43.52	188.31	0.4	8.84	25.46	9.56	1.54	1.65	16.65
8	8.2	1.12	0.35	29.01	195.44	0.56	7.9	21.22	11.76	1.24	1.75	17.15
9	8.65	0.65	0.47	60.1	248.15	0.42	8.9	22.28	7.56	1.66	1.5	16.1
10	8.55	0.54	0.4	43.52	258.58	0.42	7.66	20.16	9.46	2.28	4.1	11.8
11	8.55	0.54	0.4	43.52	258.58	0.42	7.66	20.16	9.46	2.28	4.1	11.8
12	8.25	0.28	0.31	24.87	215.76	0.68	10.74	23.34	13.99	2.06	4	10.7
13	8.68	0.14	0.5	49.74	176.23	0.44	9.7	20.16	9.94	2	2.35	13.45
14	8.64	0.29	0.26	31.09	199.29	0.56	7.54	21.75	10.92	1.78	5.35	11.15
15	8.66	0.26	0.39	60.1	329.95	0.38	7.42	23.87	8.46	1.54	6.9	12.5
16	8.34	0.74	0.43	68.39	282.74	0.48	9.08	25.99	12.48	2	2.75	7.95
17	8.32	0.56	0.3	37.3	161.96	0.48	8.2	29.17	10.86	1.78	4.05	13.15
18	8.55	0.29	0.46	51.81	248.7	0.34	8.08	38.19	7.22	1.54	5.05	11.25
19	8.3	0.77	0.35	80.82	164.7	0.46	8.84	31.83	12.24	2.5	1.85	15.25
20	8.48	0.43	0.44	47.66	197.74	0.4	8.38	39.78	10.68	1.86	2.5	15.8

***=Miliequivalent**

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

Samples site: Village : Tuvad, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
L	0	19	20	3	0	15	0	0	0	0	0	0
M	3	1	0	13	14	5	19	0	10	0	8	0
H	17	0	0	4	6	0	1	20	10	20	12	20
%L	0	95	100	15	0	75	0	0	0	0	0	0
%M	15	5	0	65	70	25	95	0	50	0	40	0
%H	85	0	0	20	30	0	5	100	50	100	60	100
S.F.I.*	2.85	1.05	1.00	2.05	2.30	1.25	2.05	3.00	2.50	3.00	2.60	3.00
LMH** of SFI	H	L	L	M	M	L	M	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. & Organic carbon and Zinc are in low amount. Farm yard manure & Zinc Sulphate should be added for better plant growth & productivity. The other parameters are sufficient. 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 : Dhanora, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
1	7.8	0.4	0.49	62.17	371.67	0.48	24.1	36.6	24.94	3.74	1.95	9.55
2	8	0.3	0.48	68.39	396.38	0.42	20.3	22.28	20.98	2.88	1.9	10.4
3	8	0.18	0.9	74.6	315.13	0.34	18.26	20.16	17.62	2.34	1.45	12.4
4	7.9	0.21	0.38	78.75	372.77	0.34	16.92	18.04	15.1	2.08	3.3	12.4
5	7.93	0.24	0.51	82.89	316.22	0.44	21.96	23.34	22.82	3.18	2.45	11.4
6	8.44	0.21	0.27	47.66	188.31	0.36	17.84	15.38	16.34	2.3	3.25	12.1
7	8.55	0.15	0.32	53.88	223.99	0.28	13.74	23.87	14.24	1.84	3.85	13
8	8.51	0.17	0.29	41.45	277.25	0.22	13.5	30.77	12.22	1.42	0.4	11.6
9	9.1	0.18	0.31	64.24	164.7	0.46	14.98	21.75	16.22	1.32	1.8	10.9
10	8.54	0.2	0.32	70.46	210.27	0.36	19.2	23.87	23.36	1.38	2.05	9.15
11	8.56	0.14	0.25	76.68	215.76	0.22	15.06	24.4	15.48	1.44	1.15	12
12	9.25	0.27	0.37	82.89	164.7	0.44	14.44	37.66	14.86	1.5	1.5	11.3
13	8.52	0.15	0.32	47.66	234.97	0.32	12.86	39.78	13.04	1.3	1.65	16.8
14	9.44	0.23	0.45	55.95	162.5	0.44	17.76	15.38	18.64	1.44	1.65	15.1
15	9.87	0.28	0.47	53.88	141.09	0.44	16.4	33.42	15.18	1.48	2	11.1
16	8.5	0.36	0.61	45.59	218.5	0.6	23.82	21.22	28.16	3.74	1.25	10.7
17	8.2	0.29	0.57	68.39	351.36	42	20.62	24.4	20.52	2.34	1.15	10.6
18	8.8	0.33	0.54	49.74	289.32	0.32	19	39.25	19.72	2.02	3	11.3
19	8.43	1.4	0.35	87.04	213.01	0.46	15.2	39.78	14.98	1.76	1.3	10.2
20	8.13	0.22	0.42	78.75	234.42	0.46	16.26	39.25	16.3	1.66	1	9.3

***=Miliequivalent**

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

Samples site: Village : Dhanora, Taluka: Sami, District: Patan , 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 g soil)	Ca (Me*/100 g soil)
L	0	19	15	0	1	18	0	0	0	0	1	0
M	7	1	4	8	13	1	0	3	0	0	13	0
H	13	0	1	12	6	1	20	17	20	20	6	20
%L	0	95	75	0	5	90	0	0	0	0	5	0
%M	35	5	20	40	65	5	0	15	0	0	65	0
%H	65	0	5	60	30	5	100	85	100	100	30	100
S.F.I.*	2.65	1.05	1.30	2.60	2.25	1.15	3.00	2.85	3.00	3.00	2.25	3.00
LMH** of SFI	H	L	L	H	M	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. & Organic Carbon and Zinc are in low amount. Farm yard manure & Zinc Sulphate should be added for better plant growth & productivity. The other parameters are sufficient. pH is in high limit, so it can be neutralized by using acidic fertilizer.

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