



STUDY OF NUTRIENTS IN AGRICULTURAL SOIL OF GANDHINAGAR DISTRICT

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Abstract

As assessment of the soil quality carried out in various villages of Mansa taluka, district Gandhinagar, Gujarat. The samples location areas were approximately 5-10 Kilometer from each other. Five representative locations were selected for the study and 20 samples from each location and direction of area were collected. Different parameters like pH, electrical conductivity, calcium, magnesium, sulphur, organic carbon, potash, phosphorous, copper, iron, manganese and zinc were measured. Low, medium & high range of above parameter also calculated from analysis data, thus the attempt has been made to find out the nutrients present in soil. 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: pH, Electrical conductivity, Nutrients, Soil.

INTRODUCTION:

Soil is a multipart of physical and biological schemes, which gives support to the plants and supplies essential nutrient to them.[1] The weathering processes disintegrate rock and convert it into nutrients soil. It forms a thin layer on surface. It contains minerals particles, organic matter, water and air. [2] This becomes a fundamental resource of life which support the growth of plants and hence human and other living organisms. In recent decade to increase the yield and production cultivable plants more and more organic and inorganic fertilizers have been added to natural soil. But due to continuous and excess use of such fertilizers, the primary constituent's status in soil is being changed. The mineral nutrients like macro and micro has unique importance in plants such as cell elongation, metabolism, O₂ evolution, N₂ fixation, respiration to constitute chlorophyll contain. [3] Williams has studied effect of pH on nutrient balance and observed that high pH of soil can affect the micronutrient content present in soil [4]. Manganese and Iron level decline with increase in soil pH. However, pH is good sign for maintain equilibrium between

nutrients in the soil. It is also an indicator of plant and other living organisms, available nutrients, cation exchange capacity and organic matter content. [5-7] The mobility of nutrients in the soil is largely depended on soil pH. 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. There are 17 essential nutrients which are required for plant growth. However, micronutrients like Fe, Mn, Zn, Cu are only easily accessible in acidic situation. [9] However, only small amounts of nutrients are available for plants. [9,10] Nutrients become available through mineral weathering and through decomposition of organic matter into inorganic mineral which are absorbed by plants in the form of ions. [11] Traditionally, an assessment of the nutrient status in the soil requires a separate extraction and measurement process for most elements; this is costly process in terms of both time and labor. [12,13] In the last decades Ion exchange resin has been used to assess the availability of plant nutrients where anion and cation ex- change resins are used in numerous ways in soil and plant analysis. [14,15] The method simulates removing ions from soil by plant roots to prevent equilibrium of ions between the solid and the solution phases. [14,16]

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) 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	25
3	2	0.010 g	65
4	3	0.015 g	98
5	4	0.020 g	122
6	5	0.025 g	155
7	6	0.030 g	180
	Total	0.105 g	645

Calculation:-

1 Reading

$$\begin{aligned}
 1 \text{ Reading} &= \text{Total Amount of Sucrose} / \text{Total Reading} \\
 &= 0.000162791 \\
 &= 0.000161043 \text{ gm Sucrose}
 \end{aligned}$$

1 Reading Carbon value:

$$\begin{aligned}
 &0.00006837 \\
 &0.00006764 \text{ gram organic carbon}
 \end{aligned}$$

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

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.

(2) 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.

(3) 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	22
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	85
6	5 ml = 10 ppm	5 ml	5 ml	1 ml	105
7	10 ml = 20 ppm	5 ml	5 ml	1 ml	197
	Total = 50 ppm				499

Calculation

1 Reading

$$\begin{aligned}
 &= \text{Total Solution of ppm} / \text{Total Reading} \\
 &= 50 / 499 \\
 &= 0.100 \\
 &0.1010 \text{ Microgram P (Graph Factor)}
 \end{aligned}$$

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)

P₂O₅ Kg/ Hectare = R X 0.1010 X 4 x 2.24 X 2.29 (2.29 = Factor in 'P₂O₅ ' Hectare)

$$P_2O_5 \text{ Kg/ Hectare} = R \times 2.0723584$$

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.

(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 °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.

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	38
3	1.5ml	15ppm	47.5
4	2.0ml	20ppm	56.5
5	2.5ml	25ppm	62.5
6	3.0ml	30ppm	75
7	4.0ml	40ppm	100
	Total	140ppm	379.5

Calculation

$$\begin{aligned}
 1 \text{ Reading} &= \text{Total Solution of ppm} / \text{Total Reading} \\
 &= 140 / 379.5 \\
 &= 0.369
 \end{aligned}$$

1 Gram Soil = R X 0.369 X 5 Microgram K / Gram Soil (0.369 Graph Factor)
R= Flame Photometer Reading of sample

K

Kg/Hectare = R X 0.369 X 5 X 2.24 (2.24 = Factor in **K** Hectare)

K₂O

Kg/Hectare = R X 0.369 X 5 X 2.24 X 1.20 (1.20 = Factor in **K₂O**
Hectare)
= R X 4.959

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) 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 suspension solution and note the reading.

(7) 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.

(8) 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.

(9) 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	12
3	2	2	23
4	3	3	33
5	4	4	45
6	5	5	53
7	6	6	65
8	7	7	83
9	8	8	102
10	10	10	130
	Total ppm	46	Total: 546

Calculation:-

1 Reading = Total ppm of Sulphar/Total reading

$$1 \text{ Reading} = 46/546$$

$$=0.08$$

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.

Result and Discussion

Critical Limits of Nutrients:-

Calculation of soil fertility Index:

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

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

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 : Ajol, Taluka: Mansa, District: Gandhinagar, Gujarat, India.

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	7.75	1.18	0.62	87.04	495.28	0.64	3.02	11.14	23.1	1.02	2.75	7.85
2	8.07	0.21	0.64	91.18	215.51	0.18	3.14	10.61	9	1.24	1.75	8.05
3	8.13	0.16	0.80	89.11	203.47	0.18	3.02	9.55	4.62	0.66	1.65	8.35
4	8.23	0.15	0.64	84.97	178.03	0.12	2.7	5.83	3.02	0.7	2.6	6.7
5	8.1	0.17	0.62	91.18	236.93	0.2	2.76	10.08	4.34	0.76	1.65	6.85
6	8.11	0.14	0.55	53.88	194.10	0.2	2.66	7.96	4.28	0.66	1.25	6.95
7	8.1	0.16	0.69	70.46	231.58	0.18	2.76	8.49	2.56	0.74	1.7	7.9
8	8.27	0.20	0.78	64.24	199.45	0.16	2.5	10.08	2.16	0.64	1.75	8.05
9	8.14	0.15	0.62	70.46	203.47	0.16	3.24	7.96	2.44	0.64	1.3	8.1
10	8.11	0.21	0.75	87.04	123.15	0.18	3.3	10.61	5.34	0.7	1.7	6.8
11	8.2	0.59	0.76	74.60	133.86	0.2	2.98	14.85	24.16	1.2	0.6	7.3
12	8.25	0.18	0.61	89.11	160.63	0.12	2.76	13.79	2.58	0.68	0.8	8.2
13	8.13	0.22	0.69	74.60	174.02	0.32	2.7	13.26	3.34	0.82	1.35	8.45
14	8.22	0.26	0.83	84.97	204.81	0.28	3.02	10.08	6.16	0.7	2.15	8.05
15	7.76	1.00	0.81	89.11	298.51	0.2	2.44	11.14	13.08	0.8	2.55	7.75
16	8.23	0.48	0.49	89.11	148.58	0.16	2.44	9.02	5.98	0.84	2.4	7.7
17	8.27	0.36	0.69	70.46	357.41	0.24	2.98	11.14	7.64	0.92	2.2	6.6
18	8.16	0.28	0.76	60.10	420.32	0.38	3.08	9.02	9.72	0.8	1.9	7.1
19	8.43	0.29	0.80	66.32	153.94	0.22	2.38	7.43	4.44	0.76	2.65	5.65
20	8.45	0.27	0.79	70.46	178.03	0.22	2.6	9.55	4.2	0.76	2.45	7.15

*=Miliequivalent

Soil Fertility Index & Soil Test Rating:

Samples site: Village : Ajol, Taluka: Mansa, District: Gandhinagar, Gujarat, India.

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	18	1	0	3	19	20	9	11	0	2	0
M	12	2	10	1	14	1	0	11	6	0	10	0
H	8	0	9	19	3	0	0	0	3	20	8	20
%L	0	90	5	0	15	95	100	45	55	0	10	0
%M	60	10	50	5	70	5	0	55	30	0	50	0
%H	40	0	45	95	15	0	0	0	15	100	40	100
S.F.I.*	2.40	1.10	2.40	2.95	2.00	1.05	1.00	1.55	1.60	3.00	2.30	3.00
LMH** of SFI	H	L	H	H	M	L	L	L	L	H	M	H

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

CONCLUSION: Above Result indicate that E.C. & Zn & Fe & Sulphur & Mn are in low Amount, Zinc Sulphate& Ferrous Sulphate & Potassium Sulphate & Manganese Sulphate should be added for better plant growth & productivity. The other parameters are sufficient in limit. pH is in High in limit so it can be Neutralized by using acidic Fertilizer.

Samples site:

Village : Padusma, Taluka: Mansa, District: Gandhinagar, Gujarat, India.

Sample No.	pH	EC	Org. Carbon (%)	Phosphorous (Kg/ Hectare)	Pottash (Kg/Hectare)	Zn ppm	Fe ppm ppm	Sulphur ppm	Mn ppm	Cu ppm	Mg (Me*/100 gm soil)	Ca (Me*/100 gm soil)
1	9.06	0.18	0.54	64.24	263.70	0.52	3.18	6.37	10.56	1.1	2	6.5
2	8.54	0.16	0.68	91.18	248.98	0.3	3.14	7.43	10.04	1.08	2.2	7.3
3	8.56	0.16	0.70	68.39	253.00	0.3	3.14	6.37	11.58	1.06	2.8	5.8
4	8.52	0.20	0.72	84.97	441.74	0.28	3.18	11.67	13.44	1.28	2.1	8.1
5	8.95	0.16	0.77	93.26	337.33	0.34	2.86	10.61	7.74	1.02	4.05	8.85
6	8.35	0.20	0.80	84.97	313.23	0.48	3.08	12.73	9.46	1.1	3.5	8.5
7	8.75	0.20	0.83	87.04	348.04	0.34	3.14	10.61	9.14	1.08	3.35	7.75
8	8.23	0.19	0.68	66.32	337.33	0.32	2.92	10.08	6.82	0.98	3.75	6.45
9	8.99	0.18	0.74	84.97	303.86	0.34	3.02	11.67	8.86	0.7	4.15	8.85
10	8.25	0.18	0.85	70.46	330.63	0.48	2.34	11.14	9.38	0.66	2.8	10.4
11	8.25	0.24	0.87	91.18	405.60	0.34	2.98	8.49	7.78	0.62	2.85	10.95
12	8.12	0.25	0.83	84.97	493.94	0.5	3.08	12.20	9.94	0.76	3.1	11.1
13	8.5	0.17	0.74	74.60	362.76	0.28	3.14	11.67	15.74	1.04	2.6	10.9
14	8.37	0.25	0.77	84.97	289.14	0.2	2.38	7.96	8.26	0.74	3.6	12.8
15	8.42	0.14	0.79	68.39	319.93	0.32	3.24	8.49	13.16	0.84	2.85	10.75
16	8.28	0.12	0.83	49.74	350.71	0.32	3.56	7.96	3.92	1.28	3.2	9.9
17	8.7	0.23	0.87	39.37	309.22	0.36	2.7	14.32	7.68	0.62	4.05	9.25
18	8.28	0.35	0.86	84.97	259.69	0.64	2.44	11.14	1.48	0.7	3.5	9.5
19	8.9	0.16	0.82	70.46	235.59	0.4	3.3	11.67	13.16	0.86	4.9	10
20	8.82	0.19	0.61	70.46	301.19	0.44	3.08	9.55	13.4	0.92	3.25	10.75

*=Miliequivalent

Soil Fertility Index & Soil Test Rating:

Samples site: Village : Padusama, Taluka: Mansa, District: Gandhinagar, 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	0	17	20	8	2	0	0	0
M	1	0	8	2	6	3	0	12	10	0	1	0
H	19	0	12	18	14	0	0	0	8	20	19	20
%L	0	100	0	0	0	85	100	40	10	0	0	0
%M	5	0	40	10	30	15	0	60	50	0	5	0
%H	95	0	60	90	70	0	0	0	40	100	95	100
S.F.I.*	2.95	1.00	2.60	2.90	2.70	1.15	1.00	1.60	2.30	3.00	2.95	3.00
LMH** of SFI	H	L	H	H	H	L	L	L	M	H	H	H

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

CONCLUSION: Above Result indicate that E.C. & Zn & Fe & Sulphur are in low Amount, Zinc Sulphate & Ferrous Ammonium Sulphate & Potassium Sulphate should be added for better plant growth & productivity. The other parameters are sufficient in limit. pH is in High in limit so it can be Neutralized by using acidic Fertilizer.

Samples site:

Village : Mansa, Taluka: Mansa, District: Gandhinagar, 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	7.62	0.23	1.09	58.03	503.31	0.34	9.7	30.77	17.26	1.46	4.9	8
2	7.72	0.55	0.90	49.74	345.36	0.32	5.74	30.24	18.16	0.9	2.8	9.7
3	7.15	0.19	1.32	43.52	273.07	0.36	6.36	38.72	19.6	1.1	0.35	9.05
4	7.54	0.20	1.29	62.17	218.19	0.56	5.88	32.89	22.8	1.4	3	8.6
5	7.72	0.22	0.95	72.53	232.92	0.34	4.76	41.37	17.06	1	2.5	8.2
6	7.18	0.23	1.06	66.32	464.49	0.36	13.24	56.23	34.52	1.28	3.35	10.05
7	7.45	0.21	0.60	51.81	381.50	0.4	3.3	33.95	12.42	1.08	3.8	9.7
8	7.20	0.23	1.03	47.66	464.49	0.5	11.36	50.39	35.88	1.36	4.7	11.2
9	7.15	0.22	1.18	41.45	469.85	0.3	10.02	33.42	34.86	1.26	2.25	8.15
10	7.80	0.26	1.03	22.80	510.01	0.34	7.22	66.31	23.96	1.4	4.15	13.65
11	7.60	0.24	0.93	24.87	514.02	0.26	11.84	63.12	36.66	1.42	3.95	8.55
12	7.23	0.24	1.23	29.01	370.79	0.36	7.74	37.13	24.58	1.08	4.2	8.4
13	7.30	0.26	1.20	64.24	259.69	0.24	10.56	51.98	36.84	1.34	2.05	8.05
14	7.80	0.22	1.41	49.74	582.29	0.34	7.3	23.34	16.42	1.28	2.45	7.15
15	7.10	0.26	1.43	31.09	491.27	0.24	11.44	42.44	8.86	1.4	2.75	6.55
16	7.15	0.28	1.47	43.52	447.09	0.3	10.72	56.23	36.36	1.42	4.7	9

17	7.20	0.26	1.23	49.74	348.04	0.36	9.02	33.95	19.64	1.48	3.1	6.7
18	7.42	0.54	0.82	68.39	393.55	0.22	6.86	54.11	18.2	1.16	3.6	7.3
19	7.62	0.43	0.89	43.52	340.00	0.16	6.08	32.89	17.52	1.08	2.15	6.35
20	7.62	0.58	0.92	49.74	318.59	0.16	5.1	31.83	17.96	1.14	2.9	7.1

*=Miliequivalent

Soil Fertility Index & Soil Test Rating:

Samples site:

Village : Mansa, Taluka: Mansa, District: Gandhinagar, 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	0	2	0	18	2	0	0	0	1	0
M	20	0	1	13	4	2	11	0	1	0	0	0
H	0	0	19	5	16	0	7	20	19	20	19	20
%L	0	100	0	10	0	90	10	0	0	0	5	0
%M	100	0	5	65	20	10	55	0	5	0	0	0
%H	0	0	95	25	80	0	35	100	95	100	95	100
S.F.I.*	2.00	1.00	2.95	2.15	2.80	1.10	2.25	3.00	2.95	3.00	2.90	3.00
LMH*												
* of SFI	M	L	H	M	H	L	M	H	H	H	H	H

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

CONCLUSION: Above Result indicate that E.C. & Zn are in low Amount, Zinc Sulphate should be added for better plant growth & productivity. The other parameters are sufficient in limit. pH is in medium in limit so it can be Neutralized by using acidic Fertilizer.

Samples site:

Village : Delvada, Taluka: Mansa, District: Gandhinagar, 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	8.80	0.53	0.76	29.01	200.79	0.34	3.78	21.75	10.72	0.82	2.45	7.65
2	9.00	0.56	0.77	31.09	253.00	0.2	4.1	31.83	4.36	0.64	0.95	11.25
3	8.45	1.00	0.80	24.87	156.62	1.18	3.68	105.03	8.28	0.58	6.95	9.95
4	8.93	0.74	0.73	26.94	322.60	0.26	3.46	79.57	6.34	0.58	1.85	8.45
5	8.70	1.00	0.56	22.8	163.31	0.52	3.02	94.42	6.14	0.42	2.8	5.5
6	8.96	0.68	0.83	24.87	246.30	0.96	3.42	37.66	6.16	0.64	2.35	8.65
7	8.90	0.54	0.89	29.01	246.30	0.34	3.46	62.59	8.42	0.62	5.8	6.7
8	8.54	1.41	0.91	24.87	291.81	0.22	3.24	122.00	3.14	0.44	1.1	10.3
9	9.13	0.48	0.82	43.52	261.03	1.12	3.28	39.78	6.84	0.42	2.85	5.65
10	9.10	0.20	0.74	64.24	151.26	0.22	3.14	30.77	4.42	0.5	2.65	4.95
11	9.11	1.97	0.89	62.17	228.90	1.06	3.56	116.17	9.66	0.42	0.9	10.2
12	9.27	0.21	0.76	43.52	253.00	0.3	3.88	64.18	8.1	0.54	2.9	6.2
13	9.28	0.42	0.64	66.32	240.95	0.52	3.38	28.64	6.26	0.48	1.9	5.8
14	9.25	0.32	0.89	49.74	224.88	1.12	3.28	55.70	4.22	0.42	2.95	4.55
15	8.76	0.46	0.91	51.81	228.90	0.26	3.42	33.95	7.54	0.44	3	6.5
16	7.98	1.00	0.92	84.97	214.18	2	3.32	98.66	16.74	0.72	1.7	15.5
17	8.47	1.00	0.90	43.52	143.23	2.46	3.5	256.73	9.74	0.58	4.5	10.5
18	8.20	0.60	0.93	49.74	211.50	0.44	3.68	35.01	3.18	0.42	3.25	7.75
19	8.60	1.90	0.91	87.04	244.96	0.24	3.32	176.11	8.2	0.44	3.25	6.75
20	8.90	1.90	0.76	64.24	147.25	0.22	3.1	99.19	3.84	0.36	5.25	6.75

*=Miliequivalent

Soil Fertility Index & Soil Test Rating:

Samples site: Village : Delvada, Taluka: Mansa, District: Gandhinagar, 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	12	0	4	2	11	20	0	6	0	2	0
M	2	8	4	10	17	3	0	0	12	1	4	0
H	18	0	16	6	1	6	0	20	2	19	14	20
%L	0	60	0	20	10	55	100	0	30	0	10	0
%M	10	40	20	50	85	15	0	0	60	5	20	0
%H	90	0	80	30	5	30	0	100	10	95	70	100
S.F.I.*	2.90	1.40	2.80	2.10	1.95	1.75	1.00	3.00	1.80	2.95	2.60	3.00

LMH** of SFI	H	L	H	M	M	M	L	H	M	H	H	H
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* = Soil Fertility Index, ** = Low, Medium, and High Soil Fertility Index

CONCLUSION: Above Result indicate that E.C. & Fe are in low Amount, Ferrous Ammonium Sulphate should be added for better plant growth & productivity. The other parameters are sufficient in limit. pH is in High in limit so it can be Neutralized by using acidic Fertilizer.

Samples site:

Village : Ridrol, Taluka: Mansa, District: Gandhinagar, 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	7.40	0.26	0.94	26.94	279.77	1.04	6.38	18.57	17.12	1.26	3.35	8.15
2	7.65	0.32	0.89	89.11	402.92	0.8	7.34	40.31	29.52	1.44	2.95	7.55
3	7.55	0.25	0.84	31.09	265.04	0.84	4.44	24.93	14.74	0.88	4.20	10.1
4	7.55	0.24	0.58	43.52	291.81	0.56	6.08	16.97	10.62	1.24	5.45	8.65
5	7.50	0.25	0.59	49.74	261.03	0.44	5.8	32.36	10.24	1.3	4.75	7.55
6	6.96	0.24	0.55	26.94	314.57	0.34	6.18	75.85	30.28	1.56	3.95	6.55
7	7.36	0.24	0.87	31.09	369.45	0.76	6.82	29.70	11.3	1.74	6.35	8.25
8	7.35	0.19	0.66	93.26	259.69	0.14	5.14	27.58	15.36	1.12	2.95	6.15
9	7.50	0.23	1.03	24.87	416.30	0.5	6.88	38.72	12.74	1.88	5.05	6.55
10	7.29	0.21	0.59	84.97	357.41	0.3	7.08	25.99	29.8	1.3	4.80	6.4
11	7.54	0.16	0.53	29.01	329.30	0.62	5.32	26.52	18.5	1.14	3.05	5.85
12	6.87	0.26	0.83	31.09	242.29	0.56	5.6	18.57	16.6	0.92	4.00	6.2
13	7.50	0.24	0.92	26.94	362.76	0.36	4.5	22.28	17.26	1.08	4.59	8.015
14	7.25	0.28	0.72	22.80	278.43	0.44	3.88	29.70	17.22	1.16	3.15	5.65
15	7.60	0.30	0.74	24.87	306.54	0.12	4.68	16.97	13.76	0.98	4.85	7.35
16	7.48	0.24	0.90	49.74	317.25	0.34	5.46	37.13	24.48	1.24	2.75	9.35
17	7.25	0.22	0.70	43.52	291.81	0.2	6.28	25.46	29.02	1.38	3.45	6.55
18	7.48	0.28	0.84	29.01	362.76	0.18	8.34	23.87	26.66	1.46	4.30	7.8
19	7.66	0.26	0.99	22.80	275.75	0.08	5.42	20.16	22.6	0.76	4.10	8.8
20	7.51	0.27	0.80	26.94	338.67	0.12	5.74	27.05	12.16	0.92	2.95	7.55

* = Miliequivalent

Soil Fertility Index & Soil Test Rating:

Samples site:

Village : Ridrol, Taluka: Mansa, District: Gandhinagar, 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	4	0	12	4	0	0	0	0	0
M	20	0	9	13	9	7	16	4	0	0	0	0
H	0	0	11	3	11	1	0	16	20	20	20	20
%L	0	100	0	20	0	60	20	0	0	0	0	0
%M	100	0	45	65	45	35	80	20	0	0	0	0
%H	0	0	55	15	55	5	0	80	100	100	100	100
S.F.I.*	2.00	1.00	2.55	1.95	2.55	1.45	1.80	2.80	3.00	3.00	3.00	3.00
LMH** of SFI	M	L	H	M	H	L	M	H	H	H	H	H

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

CONCLUSION: Above Result indicate that E.C. & Zn are in low Amount, Zinc Sulphate should be added for better plant growth & productivity. The other parameters are sufficient in limit. pH is in medium in limit so it can be Neutralized by using acidic Fertilizer.

REFERENCES :

- [1]. Lein J.K., Integrated Environmental Planning, *Blackwell publication*, **2003**.
- [2]. Mukherji S. and Ghosh A., *New Central Book Agency limited, Kolkatta*, **2006**.
- [3]. Williams D.A., *US cooperative extension, agronomy research and extension center plant science department. University of California, Davis*, **1990**, 95, 616.
- [4]. Foth, H.D. and. Ellis B. G., *Boca Raton, Florida*, **1997**.
- [5]. Marx E.S., Hart J., and Stevens R. G., *Oregon State University*, **1999**.
- [6]. Rhue, R.D. and G. Kidder., *Soil Sci. Dept., Univ. Florida, Gainesville*, **1983**.
- [7]. Reid G., Dirou J., *How to interpret your soil test. North Coast of NSW*, **2004**
- [8] P. H. Raven, R. B. Linda and B. J. George, *Saunders College Publishing, Orlando*, 1995.
- [9] E. O. McLean and M. E. Watson, *Soil Science Society of America, Madison*, 1985, pp. 227-308.
- [10] R. Durand, N. Bellon and B. Jaillard, *Plant and Soil*, Vol. 229, No. 2, 2001, pp. 305-318.

- [11] M. J. McLaughlin, P. A. Lancaster, P. W. G. Sale, N. C. Uren and K. I. Peverill, *Plant and Soil*, Vol. 155-156, No. 1, 1993, pp. 223-226.
- [12] K. J Greer and J. J. Schoenau, *Soil Technology*, Vol. 8, No. 4, 1996, pp. 287-292.
- [13] R. R. Schnabel, *Communications in Soil Science and Plant Analysis*, Vol. 26, No. 3-4, 1995, pp. 531-540.
- [14] P. Qian, J. J. Schoenau and W. Z. Huang, *Communications in Soil Science and Plant Analysis*, Vol. 23, No. 15-16, 1992, pp. 1791-1804.
- [15] S. Sato and N. B. Comerford, *Plant and Soil*, Vol. 279, No. 1-2, 2006, pp. 107-117.
- [16] M. B. Turrion, J. F. Gallardo and M. I. Gonzalez, *Communications in Soil Science and Plant Analysis*, Vol. 30, No. 7-8, 1999, pp.1137-1152.