Analysis of Nutrients in Agriculture Soil Sample of Mysuru Region

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***Abstract*— *Soil is a complex, living, changing and dynamic component of the age old ecosystem. It is subjected to alteration and can be either be degraded or wisely managed. Soil is found to be one of the key elements which sustain life on earth. Physicochemical analysis of soil has been carried out to know the quality of the soil of Mysuru region (C-208). Electrical conductivity of the soil at temperature [25^0 C] exhibited 490 µs /cm. The pH of the given soil sample exhibited 7.96. The p^H ranging between 6.8-8.0 has been recommended optimum for plant growth. The organic carbon present in the soil C-208 is exhibiting 0.65% and organic matter is 0.999%. The total nitrogen determined by alkali permanganate method was found to 519.715 Kg/ha. The concentration of phosphorus in Kg/ha is 240.7. The concentration of potassium determined by flame photometry in the soil sample revealed that 71.136 Kg/ha. The exchangeable calcium and magnesium present in the soil sample determined by complexometric tiration was found to be 195.106 ppm and 100.63 ppm. Above physicochemical study gives the information about nature of soil present and also nutrients present in the soil. So that farmers will arrange the fertilizers and nutrients needed to the soil to increase the yield of crops.*

***Keywords*— Nutrients, Soil, Crops, Physicochemical, Spectrophotometry.**

I. INTRODUCTION

Soil is a complex, living, changing and dynamic component of the age old ecosystem. It is subjected to alteration and can be either be degraded or wisely managed [1]. Soil is found to be one of the key elements which sustain life on earth. It acts as an important part of all terrestrial systems providing habitat for micro-organisms, plants and animals. So many biological, chemical and physical factors determine soil quality [2]. By measuring some of these components and determining how they respond to management in an agricultural content, a foundation for assessing the health of the soil can be established. Ultimately, indicators of sustainability can be grounded in the assessment of soil conditions and how they change as a result of the choices a farmer makes in managing the agro ecosystem [3].

Soil analysis is a valuable tool for farms it determines. The inputs required for efficient and economic production. A proper soil test will help ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil [4]. It will also allow to determine line about the changing fertility of the soil in each field invest wisely in fertilizer and lime to produce the most economically crop yields a soil test provides the needed information about soil pH, lime need and available nutrient levels [5]. There are various types of soils found in Indian soil on the basis of major factors such as climate, altitude and composition of bedrock etc., [6]. Black, Red and Yellow, Laterite 1, Saline, Alluvial, Desert Mountain, Peat soil are some of the examples [7].

Percentage of nutrients and also physical properties are studied by using methods as mentioned below. Mainly soil test can be classified for the agriculture purpose into two types 1. Physical method 2. Chemical method [8]. Pysico-chemical parameters for testing of soil have been thoroughly studied by Patil P. N., Sawant D.V., Deshmukh R. N., from department of Engineering. They focused on analysis of physico chemical parameters of soil in a protected forest ecosystem of Askot Wild Life Sanctuary in the district of Pithoragarh ,Uttarkhand, India. The soil moisture showed fixed seasonal trend with maximum in rainy season (20.55%± 3.90) (Aug) and minimum in summer season (8.84%±3.96) (May). The mean values of water holding capacity was maximum during January (50.95%) and minimum during November (42.1%). The soil pH was acidic in nature and ranged from 5.3 to 6.5. The soil organic matter was maximum (3.76%) in low altitude forest at site 11 (Baram) (900-1000m).

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Dr Tony Hartshorn, Dept. of Geology and Environmental Science, James Madison University said "no single soil property such as pH or percept soil organic matter can be explained patterns of landmine functionality, particularly where we were able to quantify soil properties associated with functional and non –functional Landmines of the same type (e,g., PMN) M14, M35 [9]. Nevertheless, this study shows that several soil properties appear promising as indices of environmental setting likely to be associated with rapid aging (degradation) of landmines, including very 'high level' or 'master' soil carbon. Furthermore, our results suggest several more 'esoteric' variables could also be useful in 'fingerprinting' landmine aging (e,g., soil carbon –to-nitrogen ratios (C:N) or levels of tin, antimony or other trace elements used in the manufacturing of landmine components.

A. Anita Joshi Raji, V. and Umayoru Bhagan (Deparment of Chemistry, Ponjesly College of Engineering, Anna University, India) (N.1.College of Arts and Science, M.S University, India). have analysed the fluoride concentration and some other important physico-chemical parameters of 51 surface soil samples and 51 underground water samples of ten fluorotic areas of Agastheeswaram Union, South India. In all the underground water samples, the fluoride concentration in the soil was ranging between 2 to3.5 ppm and in the water samples it was ranging between 1.3 to 2.7 ppm. Both the levels found to be above the permissible limit. Other parameters such as pH alkalinity, total hardness, calcium, magnesium, chloride, salinity and sodium were also measured [10,11]. According to government of India (2012), much importance had been given now to the use of fertilizers in order to enhance the productivity. Certain aspects related to use of organic manures and recycling of biomass need to be promoted, mixed/intercrops of pulses in all major cropping system should be encouraged. N-fixing another useful trees/bushes as hedges on bounds for insitu production of biomass should be used only on the basis of soil test recommendations [12,13]. In the present investigation soil from Mysuru region labelled as C-208 has been subjected for physical methods of analysis and chemical analysis such as determination of organic carbon, nitrogen, phosphorus, potassium, exchangeable Ca and Mg.

II. MATERIALS AND METHODS

All chemical and standards used in this experiment are of high purity and from reputed firm and are potassium hydrogen phthalate, potassium dihydrogen phthalate, disodium hydrogen phosphate, potassium dihydrogen orthophosphate, sodium tertraborate, potassium dichromate, concentrated sulohuric acid, silver sulphate, orthophosphoric acid, ferrous ammonium sulphate, sodium fluoride, ferroin indicator, potassium permanganate, boric acid, liquid paraffin, P-free sodium bicarbonate, activate charcoal, ammonium para molybdate, phenolphathalein indicator, ammonium acetate solution, concentrated ammonium hydroxide.

Fig.1: Soil sample used for analysis (C-208).

III. EXPERIMENTS ON PHYSICAL METHOD OF ANALYSIS OF SOIL

1. Measurement of Electrical conductivity (EC) in Soil by Conductometer:

About 0.01 N potassium chloride solution was freshly prepared in distilled water and make upto to one liter. This solution gives an electrical conductivity of 1411.88×10^{-3} i.e, 1.41 s/m at 25 ^{0}C [13,14]. With the help of standard KCl solution the conductivity cell was calibrated and the cell constant was determined. The soil water suspension in the ration of 20 g: 50 mL was prepared for the determination of conductivity measurements can also be used for pH measurement. After recording the pH, allow the soil to settle at the bottom. Suspensions in the beaker were allowed to settle for additional half an hour (the total intermittently shaking period is 1 hr). After the calibration, the conductivity cell dipped in the supernatant of the soil water suspension, conductivity of the test solution was measured in proper conductance range. The cell removed from soil suspension, cleaned with distilled water and dipped in a beaker of distilled water. EC was expressed as ds\m. The temperature of soil water suspension was also recorded during the test.

2. Determination pH in Soil using pH meter:

Standard buffer solutions were prepared freshly by dissolving tablet each of pH 4, 11 and 9.2 dissolved in distilled water separately and made up the volume to 100 ml [13,15]. About 20 g of 2.0 mm air dry soil was weighed into a beaker, 50 ml of distilled water added and stirred with a glass rod thoroughly for about 5 minutes and kept a side for half an hour. In the mean time turn p^H meter on, allowed it to warm up for 15 minutes, Standardize the glass electrode using standard buffer of pH-7 and calibrated with the buffer pH -4 or pH-9.2. The electrodes dipped in the beakers containing the soil water suspension with constant stirring. While recording pH, switch the pH meter to pH reading andthe pH value recorded to the nearest 0.1 unit. Put the pH meter in standby mode immediately after recording. The electrode removed from soil suspension and cleaned with distilled water. The electrode rinsed after each determination and carefully then dry with filterpaper before the next determination. Standardize the glass electrode after every 10 determinations. Dip the electrodes in distilled water, when not in use and ensure that the reference electrode always contains saturated potassium chloride solution in contact with solid potassium chloride crystals. Three to four drops of toluene are added in standard buffer solutions to prevent growthof moulds.

IV. CHEMICAL METHODS FOR THE ANALYSIS OF NUTRIENT IN SOIL

1. Determination of Total Organic Carbon in Analysis of Soil by Walkely and Black Method:

1 gm of 0.55 mm sieved soil was weighed into dry 500 mL conical flask. 10 ml of 1 N $K_2Cr_2O_7$ added into the flask with pipette and swirl [16, 17]. About 20 mL of conc. H_2SO_4 was added and swirl gently until soil and reagent are mixed then more vigorously for one minute. The reaction was allowed to proceed for 30 min on asbestos sheet to avoid burning of table due to release of intense heat due to reaction of sulphuric acid. Slowly 200 ml of distilled water added, 10 ml of concentrated orthophosphoric acid and about 0.2 g of NaF added and allowed the sample to stand for 1.5 hr. The titration end point is clear in a cooled solution. Just before titration 1 ml ferroin indicator was added into the conical flask. The excess $K_2Cr_2O_7$ was titrated with 0.5 N ferrous ammonium sulphate till the colour changes from yellowish green to greenish and finally brownish red at the end point. Simultaneously blank test was also run without soil. Organic carbon in % was calculated by the following formula.

B = Titer volume of blank, S= Titer volume of Sample.

$$\text{Organic, carbon, in, percentage} = \frac{(B - S) \times NFAS \times 0.003 \times 100 \times 1.3}{Sample\ Weight}$$

2 Determination of Total Nitrogen in Analysis of Soil (AVAILABLE NITROGEN) by Alkali Permanganate method

Mineralizable Nitrogen: In case of soil sample mineralizable nitrogen is estimated as an index of available nitrogen and number of total nitrogen [18]. The easily mineralizable nitrogen is estimated using $KMnO_4$, which oxidizes and hydrolyse the organic matter present in soil, the liberated NH_3 is absorbed in boric acid and titrated against standard acid, the method hasbeen widely adopted to get a reliable index of nitrogen availability. Use of glass checking beads during heating is recommended in open nitrogen estimation by kjeldahl's method. Weigh about 20 g of soil sample in a 100 ml kjeldahl's flask. Moisture the soil with 10 ml of distilled water mask down the soil if any adheringto the flask. Add 100 ml of 0.1N $KMnO_4$ solution, add few glass beads and 2-3 ml of paraffin liquid. About 100 ml of 2.5% NaOH added. Measure the 20 ml of 2% boric acid with mixed indicator in 250 ml conical flask and place it under the reversible tube, dip the reverse tube in the boric acid, then add tap water through the condenser. Titrate the distillate against 0.02 M sulphuric acid taken in

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burette to till pink colour appear. Run a blank without soil sample.

$$\text{Organic, carbon, in, percentage} = \frac{\text{V1} - \text{V2 x N x14 x 1000 x 2.24}}{Weight\ of\ the\ Sample}$$

Where $V_{1=}$ ml of standard H_2SO_4 used to titrate soil sample,

V_2 =ml of standard H_2SO_4 used to titrate blank, N= Normality of standard sulphuric acid

W= Weight of sample taken in g

3. Determination of Total Phosphorous in Analysis of Soil using UVSpectrophotometer:

About 5 gm of soil sample weighed in 250 ml plastic conical flask, pinch (0.3 g) of phosphate free activated charcoal added, 50 ml of Olsen reagent added and shaken for 20 minutes exactly on platform type shaker at 180 rpm [19]. The contents were filtered immediately through filter paper. About 5ml of aliquot transferred into 25 ml volumetric flask. About 5 ml of filtrate was pipette out into 25 ml volumetric flask. About 4ml of freshly prepared ascorbic acid and ammonimum molybdate solution was added. Shake well and kept aside for 30 minutes then volume was made upto the mark. Prepare the standard curve using 0, 1, 2, 3, 4 and 5 ml of 5 ppm standard phosphorus solution into 25 ml volumetric flask and develop the colour using the same procedure as above. The corresponding phosphorus concentration will be 0, 0.2, 0.4, 0.6, 0.8 ppm. The absorbance and colour intensity at 690 nm measured after half an hour. Blank was also run without soil sample.

4. Determination of Total Potassium in analysis of soil using Flamephotometer:

Potassium is the most critical essential element in influencing plant growth and production throught the world. Potassium plays essential role in plants. It is an activation for dozens of enzymes responsible for plant growth and for translocation of sugars. Also it exerts a balancing effect of both nitrogen and phosphorous .Thus, it is essential to calculate the available potassium content in the given soil. Standard potassium stock solution was prepared by dissolving 1.908 gm chemically pure KCl in distilled water, make up the volume to 1 liter. This solution contains1000mg/ml of K (1000 ppm). It serves as standard stock solution. Also prepare working solution of 100 ppm from this primary stock solution by diluting 10 ml to 100 ml volume. Pipette 0, 1, 2, 4, 6, 8 and 10 ml of 100 ppm solution in 100 ml volume flask separately and make up the volume with NH_4OAC Solution. Take 10ml of digest sample and 40ml of distilled water, mixed well, after 5 minutes 2ml of ammonium molybdate and 2 drops of stannous chloride solutions were added.

$$\text{Potassium in ppm} = \frac{\text{Reading} \times \text{Total volume} \times 2.24}{Weight\ of\ the\ Sample}$$

5. Determination of exchangeable Calcium and Magnesium by complexometric titration.

Ethylene diamine tetra acetic acid is hexadentate ligand. It has six potential sites for bonding with metal ion. In strongly basic solution (pH 10) all the HCOOH groups are deprotonated and forms 1:1 complex with variety of multivalent metal ions like Mg^{2+}, Ba^{2+}, and Ca^{2+} etc. The indicator used in EBT. In the pH range 7-11 the indicator is blue in colour. In the pH range below 5.5 the indicator is red in colour. To the metal indicator complex which is wine red in colour, when EDTA is added will displace the indicator from the metal indicator complex and forms metal EDTA complex, just after and end points. On the contrary Patton reeder's indicator is possible to determine the calcium alone in the presence of Magnesium in the soil sample (Day and Underwood).

Standardization of EDTA: Pipette out 10 mL of 0.01 M standard $ZnSO_4.7H_2O$ into a clean conical flask. Add 3mL of buffer solution, one test tube full of distilled water and few drops of indicator. Titrate against EDTA solution taken in the burette till the wine-red colour change to blue. Repeat the titration for concordant values.

Determination of total calcium and magnesium by EDTA titration: Pipette out 5mL of the extract sample solution into conical flask, dilute it to 10mL and add 3mL of buffer solution titrate against EDTA solution taken in the burette using EBT as an indicator. Titration carried out till the colour changes from wine red to blue. Note down the values, to determine concentration of calcium and magnesium in the extract sample.

Determination of calcium alone: Pipette out 5 mL of the extract sample solution into conical flask, dilute it to 10mL and 2mL of 8M KOH solution titrate against EDTA solution taken in the burette using Patton reeder's indicator. Titration is carried out till the colour changes from wine red to blue. Note down the values, to determine concentration of calcium alone in the sample extract. Soil sample preparation was carried out by suspending 10g of soil sample in 100ml of ammonium sulphate, stirred for 10to 15 min followed by filtration using Whatmann filter paper no.1.

V. RESULT AND DISCUSSION

Physical and chemical property of soil sample was studied. Electrical conductivity of the soil at temperature [25^0 C] exhibited 490 µs /cm. On comparing the result with the rating. The soil sample (C-208) is a good soil, has good influence on seed emergence. The p^H of soil is one of the most important physicochemical parameter. It affect the mineral nutrient soil quality and much micro organism activity [20]. The pH of the given soil sample exhibited 7.96. The p^H range 6.8-8.0 has been recommended optimum for plant growth [21]. Hence our sample is moderately alkaline.

The organic carbon present in the soil C-208 is exhibiting 0.65% and organic matter is 0.999% (table 1).

Table 1: Determination of Organic carbon by Walkely and Black method

Sl.No	Lab Sample No.	Blank Reading (B)	Burette Reading (S)	Difference (B-S)	Organic Carbon in %	Organic Matter in %
1	C-208	20.2	16.8	3.4	0.65%	0.999%

Ratings: Organic carbon in percentage

- Less than 0.20 Very low
- 0.21 to 0.40 low
- 0.41 to 0.60 Moderate
- 0.61 to 0.80 Moderately high
- 0.81 to 1.0 High
- More than 1.0 Very high

From the above report and ratings, the soil sample (C-208) has moderately highof organic carbon so the soil is fertile.

The total nitrogen determined by alkali permanganate method was found to 519.715 Kg/ha. According to the following ratings moderately high concentration of nitrogen was found in the soil sample.

Ratings: Nitrogen Kg/ha

- Very low < 140
- Low 140- 280
- Medium 281 -420
- Moderately High 421 -560
- High 562 -700
- Very high > 701

The concentration of the phosphorus in the soil sample was found to be 140 ppm from calibrated graph. The concentration of phosphorus in Kg/ha is 240.7 (table 2).

Table 2: Depicting the concentration of Phosphorus in Soil C-208

Concentration in mg/L	Wavelength in nm
0.108%	690
Concentration of phosphorous in ppm	Concentration of phosphorous in Kg/ha
140	240.7

Ratings: phosphorous (Kg /ha)

- Very Low-< 70
- Low- 70-130
- Medium – 130-220
- Moderatly high -220-280
- High – 280-350
- Very high -> 350

From the above rating, it is concluded that the soil is having phosphorus in moderately high concentration.

Table 3: Depicting the concentration of Potassium in Soil C-208

Sl .No	Lab sampleNo	Readings onFlame Photometer	Concentration of K in kg/ha
1	C-208	6.375	71.136

The concentration of potassium determined by flame photometry in the soil sample revealed that 71.136 Kg/ha (table 3).

Ratings: Potassium (K) –kg/ha

- Very Low ≤ 120
- Low 121-180
- Moderate 181-240
- Moderately high 241-300
- High 301-360
- Very high ≥360

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In this experiment from the data obtained by the report is compared with therating conclude that the sample (C-208) has very low potassium content.

The exchangeable calcium and magnesium present in the soil sample determined by complexometric tiration was found to be 195.106 ppm and 100.63 ppm. Table 4 represent the overall physicochemical parameters of the soil C-208 with values

Table 4: Physicochemical parameters of the soil C-208

Sl.No	Physicochemical parameter	Values
1	Conductivit in (ds/m) (a) At 25^0 C	490.0µc/cm
2	p^H (a) At 20^0 C (b) At 26^0 C	(a) 7.96 (b) 7.97
3	Organic Carbon in percentage	0.65%
4	Total nitrogen in percentage	519.715 kg/ha
5	Total Phosphorous in percentage	240.7 kg/ha
6	Total potassium in percentage	71.136 kg/ha
7	Exchangeable Ca	195.1063 ppm
8	Exchangeable Mg	100.63 ppm

VI. CONCLUSION

The physicochemical study of parameters is important to agricultural chemist for plant growth and soil management [22, 23]. A physicochemical study of soil sample of Mysore region gives the information about nature of soil present and also nutrients present in the soil. According to this information farmers arrange the amount of which fertilizers and nutrients needed to the soil to increase the yield of crops. The results obtained from the analysis of soil samples showed us that the organic carbon has been reduced which implies that our dependence on chemical fertilizers are so high that we have forgotten the gift of mother nature, Fallen leaves, weeds after cutting, coffee pulp, Paddy husk, cowdung, everyday vegetable wastes can be converted into organic manure and can be used for cultivation. This can help bringing up the organic carbon content in the soil to a fertile 5%.

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