QUANTITATIVELY ANALYSIS OF SOME SOIL SAMPLES FROM DIFFERENT PLACES OF CHANDRAPUR, MAHARASHTRA, INDIA.

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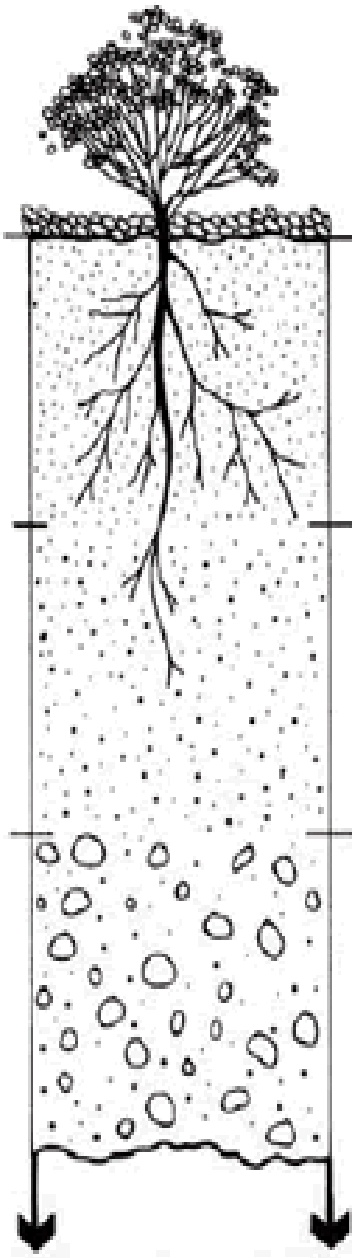
Abstract

The environmental quality is greatly focused on soil because of their importance in maintaining the ecosystem. Soil and water are the two essential sources of life. The organic matter, minerals, soil microbial biomass stock over the soil profile are known to be indicator of soil. For the quality testing, soil is examined by taking physiochemical & biological parameters that has major impact on agricultural productivity & human health.

1. Introduction

Soil is a complex mixture of solids, water and gases and form topmost layer of the earth's crust. It particularly formed by the Breakdown of rocks and minerals on the surface of the earth. The remainder of soil is composed of organic compounds from the decomposition of plants, animals, insects, bacteria, mould and fungi. Water and air are trapped in the spaces between soil particles. The components of soil can vary widely. No two soils are the same even if they are in the same general classification. The composition of the soil may vary depending on physical and chemical factors of that location. which vary due to location. Soil provides anchorage, an absorbing/adsorbing media, a source of nutrients and water for plants. It also provides some nutrients for bacteria, mould, insects and invertebrates which live on and below the surface of the soil.

There are six different layers or horizons that make up the mature soil profile. These horizons are represented by alphabets O, A, E, C, B and R. Immature soils lack some of these layers.



1.OHorizon (Organic Layer): Decomposing plant material on the surface of the soil.

2. A Horizon (Topsoil): A mixture of organic and mineral matter. If uncompacted it should

have an open texture with space for water and air between the grains of organic and mineral matter. Normally, darker soil contains more organic matter. Most alpine and subalpine soils in the Kosciuszko alpine area are high in organic matter.

3.E Horizon (Eluviation Layer): This layer consists of nutrients leached from O and A horizons. E horizon is absent in most soils but more common in forested areas.

4. B Horizon (Subsoil): Usually high in clay or fine particles but in the alpine and subalpine areas it may be gravely due to the breakdown of the underlying granitic rocks. Generally, sub soils are more compact or dense than the topsoil. A few deep roots may reach into the subsoil but most will remain in the topsoil.

5. C Horizon (Parent Rock): It lies just below the subsoil. It is called the parent rock because all the upper layers developed from this layer. Broken down, weathered material from the underlying rock making it hard.

6. R Horizon (Bedrock): Found beneath all the layers, it consists of un-weathered igneous, sedimentary and metamorphic rocks. It is highly compact.

2. Material and Method

2.1 Study Area

Our study deals with the quantitative analysis of some soil samples collected from following three villages of Chandrapur district, Maharashtra, India.

1. Chinchala
2. Nagala
3. Padoli

2.2 Soil Testing Method

2.2.1. Determination of soil pH

Soil is brought to saturation stage with distilled water and pH is measured with the help of pH meter.

Apparatus: pH meter, beaker, spatula and magnetic stirrer

Procedure: Take 20 gm of air-dried soil in a beaker and add 50 ml of distilled water and keep it for stirring for at least 1 hour. Filter the mixture and measure the pH of the filtrate with the help of pH meter

2.2.2. Determination of electrical conductivity of soil

Preparation of 1:1 soil-water extract

Weigh 20 grams of soil into a 50 ml shaking bottle. Add 20 ml distilled water and shake for 30 minutes. Filter with Suction. Determine the conductivity with a Salt-Bridge.

Procedure: Place 50 to 100 grams of soil in a 250 ml beaker and add distilled water and stir thoroughly until the soil is completely moist. Let the soil set for at least an hour. Transfer soil into a suction funnel and filter. Determine conductivity with a Salt-Bridge.

2.2.3. Determination of organic carbon in solid

Soil organic carbon is determined by treating the soil with a known amount of $K_2Cr_2O_7$ in presence of conc. H_2SO_4. Here, oxidation of organic carbon by $K_2Cr_2O_7$ takes place.

Apparatus: Analytical balance, conical flask, pipette, burette, measuring cylinder

Reagents:1N $K_2Cr_2O_7$ (dissolve 49.04 g of $K_2Cr_2O_7$ in distilled water and make up to 1 litre)**,** Concentrated H_2SO_4 (93%)**,** H_3PO_4 (85%)**,** Diphenylamine indicator (dissolve 500mg diphenylamine indicator in a mixture of 100 ml conc.H_2SO_4 and 20 ml distilled water), 0.5N Ferrous ammonium sulphate (dissolve 0.5 gm of A.R. grade $FeSO_4$ $(NH_4)_2SO_4.6H_2O$ in water. Add 15 ml sulphuric acid and dilute to 2 L)

Procedure: Take oven dried soil sample passed through 0.5 mm screen. Put 1 gm of soil in 500 ml conical flask. Add 10 ml 1N pot. Dichromate and 20 ml conc.H_2SO_4 and mix by gentle shaking. Keep the flask to react the mixture for about 30 minutes. After completion of reaction, dilute the content with 150 ml distilled water and stay for about 10 to 15 min and add 10 ml o-phosphoric acid followed by 1 ml of diphenylamine indicator. Titrate the sample with ferrous ammonium sulphate solution till the colour changes from blue to brilliant green. In a similar manner carry out a blank determination also and calculate the results.

2.2.4. Determination of Total Nitrogen

Principle: Since sample contain organic as well as nitrate nitrogen. The material is digested with sulphuric acid and salicylic acid in the presence of K_2SO_4, $FeSO_4$, and $Na_2S_2O_3$. In this process K_2SO_4 raises the boiling point of H_2SO_4 and $CuSO_4$ is used as catalyst. Salicylic acid forms nitro compound, which is reduced by $Na_2S_2O_3$ to amino compound. The process of digestion takes about 3 to 4 h changing the whole of Nitrogen into ammonium sulphate, it is then made alkaline with 45% NaOH and distilled. Ammonia gases produced is absorbed in 4% boric acid solution and titrate with 0.1N HCl.

Reagents: Sulphuric acid- salicylic acid mixture (To 600 ml of con. Sulphuric acid add 20 gm salicylic acid.), Sodium thiosulphate ($Na_2S_2O_3$, H2O), Potassium sulphate mixture (20 Parts of K_2SO_4 + 1-part $CuSO_4$ + 4-part $FeSO_4$), 0.1 N Hydrochloric acid (Measure 8.9 ml con. HCl and make up the volume 1 lit), 4 % Boric acid (Dissolve 40 g boric acid in 1 lit. distilled water. Add 5ml mixed indicator and adjust the stock solution by adding dilute sulphuric acid or hydrochloric acid until the bluish color of the indicator weaken toward pink), Mixed Indicator (Dissolve 0.5 gm of bromocresol green and 0.1 gm of methyl red in 100 ml of ethyl alcohol. Adjust this solution with dilute NaOH or HCl to bluish purple mid color)

Procedure: Weight 2-3 gm of air-dried material in 300ml Kjeldahl flask, moisten with little water and then add 25 ml of sulphuric acid – salicylic acid mixture rotating the flask to ensure complete contact of the acid with the material. Shake it for some time and then add 5 gm $Na_2S_2O_3$. Heat it gently for 5 min. and cool. Add 10 gm of potassium sulphate, copper sulphate, ferrous sulphate and heat it strongly until the solution is clear. Continue the heating for another 2hrs to complete the digestion. The temperature during the digestion should be maintained at 300^0C.Now pipette out 25 ml of 4 % boric acid solution in receiver and add 5 drops of mixed indicator. Place this flask in the distillation apparatus and dip the end of delivery tube in boric acid. Dilute the digested material with 150ml water and transfer it to a 800ml Kjeldahl flask and put a few pieces of porcelain to avoid bumping. Take about 100ml of 45% caustic soda and add it in such a way that it runs down to the bottom without mixing. Fit it immediately in the distillation apparatus and light the burner. Mix the solution thoroughly by swirling and continue distillation till about 150ml of the distillate have been collected. Disconnect the receiver first and then put off the burner. Titrate the boric acid solution with 0.1N HCl till the blue color just disappears and tends to turn pink. Also keep a blank without adding the substance under analysis and titrate in same way surface.

2.2.5. Determination of Available Phosphorus

Principle: In this method the soil is shaken with 0.5M Sodium Bicarbonate at the nearly constant pH 8.5 in presence of activated charcoal & extract is treated with ammonium molybdate which result in the formation hetero poly complex known as Phosphomolybdate which is reduced with stannous chloride. Here complex formation takes place, which give the blue colour. The intensity of blue colour is proportional to the quantity of phosphorus entering into the reaction yielding a complex known as Molybdenum Blue.

Reagents: 0.5 M Sodium bicarbonate (Dissolve 42.01 grams NaHCO3 in distilled water and make up to 1 L. Adjust the pH to 8.5 with NaOH), Ammonium molybdate (Dissolve 15.0 grams ammonium molybdate in 300 ml of warm distilled water (600 C).Filter if necessary and add to the solution, after cooling, 342 ml of concentrated HCl gradually with mixing. Make up to 1 L), Stannous Chloride (a. Stock solution - Dissolve 10 grams Tin Di-hydrate chloride in 25 ml concentrated HCl. Prepare fresh every two months or less. Use large crystals rather than fine powder. b. Dilute solution - Add 0.5 ml of the stock solution to 66 ml of distilled water. Prepare fresh for each set of determinations or at least once a day), Standard phosphate solution (Dissolve0.2195-gram pure Mono potassium Phosphate in distilled water. Dilute to 1 L with bicarbonate extracting solution. This solution contains 50 pm of phosphorus and serves as the base stock solution. Standard solutions of 0.5 to 5 ppm P can be made up when needed)

Procedure: Weight out 2.5 grams of soil into a 50 ml shaking bottle and add 25 ml extractant. Shake for 30 minutes. If resulting soil solution is coloured, decolorize with Darco G-60. Use about 4 tea spoons for each 25 ml extract, or more if necessary. Filter through What man No. 5 filter paper. The Darco G-60 may be added to the soil prior to shaking. (The Darco G-60 should be tested for phosphorus and if it contains enough to colour the solution, it should be washed with sodium bicarbonate before using.) Place 5 ml of the filtrate in a 25 ml volumetric flask. This can be done with an automatic pipette. With an automatic pipette add 5 ml of ammonium molybdate solution to each flask and shake well. Remove all traces of the molybdate solution from the neck of the flask by washing down with distilled water until approximately 10 ml has been added. Add 1.0 ml of the dilute stannous chloride solution, mix well immediately, make up to volume with distilled water and again shake thoroughly.

2.2.6.Determination of Available Potassium from given soil samples by Flame Photometer

Reagents: Ammonium Acetate Extraction (Take 58 ml of Glacial Acetic acid in 500 ml measuring Cylinder & make the volume to 400 ml with distilled water. Mix these two solutions & adjust the pH to 7.0 by addition of Ammonium Hydroxide or Acetic acid as necessary. Prepare Total Volume (t) 1000 ml with distilled water), Stock K Solution (10 mg/ ml k) Dissolve 1.907 gm oven dried (110 ^{0}c) KCl in some D/W and dilute to 1000 ml. (10 mg k / ml), Working K Solution(Take 10 ml of stock solution & dilute to100ml)

For Concentration in the range of 0 -10 mg/L: Take 0.1,0.2,0.3,0.4,0.5ml of working solution in Nessler's tube & dilute to 50 ml using d/w (2,4,6,8,10 mg/l of K)

For Concentration in the range of 0 - 100 mg/L:Take 1.0, 2.0, 3.0, 4.0, 5.0 ml of Working Solution.

For Concentration in the range of 0 - 1000 mg/L:Take 10,20,30,40,50 ml of working solution in Nessler's tubes & dilute to 50 ml using d/w (200,400,600,800,1000 mg/l of K)

Procedure:

Preparation of Standard Curve:

Atomize 10 PPM K Solution & Calibrate the Scale to 100

Atomize Remaining working solution & record Galvanometer reading.

Plot the Graph as reading Vs Concentration in mg/L.

Accordingly plot the graph for 0-100 mg/L& 0-1000 mg/L ranges.

Preparation of soil extract:

Weight 2.5 gm of oven dried soil sample. Add 25 ml Neutral Ammonium acetate extract

Shake for half hour intermittently & filter the contents. Use the clear filtrate for the determination of K.Atomize the Sample & record the readings. Find concentration of K from the graph.

Results

Table No. 1: pH of soil samples

Parameter	Sample No.	Name of Area	pH
pH	01	Chinchala	7.74
	02	Nagala	7.48
	03	Padoli	7.54

Table No.2: Electrical conductivity of soil samples

Parameter	Sample No.	Name of Area	Conductance (Millie Mhos/Cm)
Electrical Conductivity	01	Chinchala	0.56
	02	Nagala	0.42
	03	Padoli	0.64

Table No. 3: Organic carbon of soil samples

Parameter	Sample No.	Name of Area	Carbon (%)
Organic Carbon	01	Chinchala	0.382
	02	Nagala	0.386
	03	Padoli	0.391

Table No. 4:Nitrogen of soil samples

Parameter	Sample	Name of Area	Nitrogen (%)
Nitrogen	01	Chinchala	0.028
	02	Nagala	0.026
	03	Padoli	0.026

Table No.5:Phosphorus of soil samples

Parameter	Sample No.	Name of Area	Phosphorus (%)
Phosphorus	01	Chinchala	0.0032
	02	Nagala	0.0038
	03	Padoli	0.0038

Table No. 6: Potassium of soil samples

Parameter	Sample No.	Name of Area	Potassium (%)
Potassium	01	Chinchala	0.0314
	02	Nagala	0.0322
	03	Padoli	0.0326

Conclusion

Study of various parameters of soil samples taken from three villages of Chandrapur district have been presented here. For Chinchala, Nagala and padoli, pH of soil samples was found to be 7.74, 7.48, 7.54 respectively. Electrical conductivity of soil samples was found to be 0.56, 0.42, 0.64 respectively. Organic carbon present in soil of Chinchala, Nagala and Padoli was found to be 0.382, 0.386, 0.391 % respectively. Amount of nitrogen present in soil samples of Chinchala, Nagala and Padoli was found to be 0.028, 0.026, 0.026 % respectively. Phosphorus content present in soil samples was found to be 0.0032, 0.0038, 0.0038 % respectively. Amount of Potassium present in soil samples of Chinchala, Nagala and Padoli was found to be 0.0314, 0.0322, 0.0326 respectively.

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