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Characterization of Soil Quality Physical and Chemical Criteria Around Thirumangalam Area

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Abstract: *Soil plays a crucial role in agriculture and building construction. Soil has different physical and chemical properties. The study of physical and chemical parameters of soil sample in Thirumangalam are were analyzed and this study reveals that the soil sample in that area is suitable for growing agricultural crops like Aloe vera, Cabbage, Garlic, Onion, Celeriac, Brussels sprout, Broccoli etc... and has low range of heavy metals.*

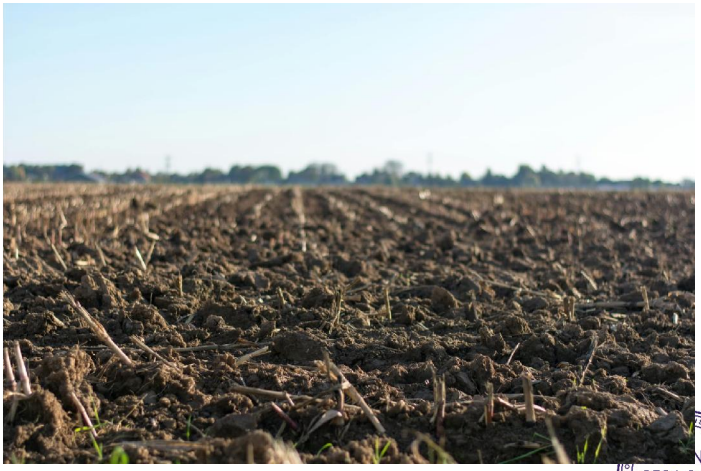
Keywords: Chemical and Physical parameters, Agricultural lands

I. INTRODUCTION

The soil is a mixture that contains minerals, organic matter, and living organisms. But broadly speaking, soil can refer to any loose sediment. Nutrients for healthy plant growth are divided into three categories: primary, secondary and micronutrients. (N), (P) and (K) are primary nutrients, which are needed in fairly large quantities compared to the other nutrients. (Ca), (Mg) and (S) are secondary nutrients which are required by the plant in lesser quantities but are no less essential for good plant growth than the primary nutrients. (Zn) and (Mn) are micronutrients which are required by plants in very small amounts. Most secondary and micronutrient deficiencies are easily corrected by keeping the soil at the optimum pH value. The chemical nature of soils is determined by the combination of mineral and organic matter that makes up the soil 2. There are three important nutrients required by plants. Nitrogen and phosphorus are required in appreciable quantities, while needs for sulphur are less. Typically, the soil consists of 45% minerals, 50% empty spaces or voids and 5% organic matter. Furthermore, soil performs many important functions such as:

- Providing a growth medium for the plants
- Acts a modifier of the earth's atmosphere
- One of the most crucial components of the biosphere
- Provides habitat for organisms

Good soil structure contributes to soil and plant health, allowing water and air movement into and through the soil profile. Soil stores water for plant growth and supports machine and animal traffic.



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While some soils are naturally better structured than others, some physical characteristics of soils can be changed with good management.

It is important to monitor the physical characteristics of soil to understand soil conditions. The soil is composed of different components: 5% organic matter, 45% minerals, 20-30% different gases and 20-30% water. Therefore, the soil is known as a heterogeneous body. Organic substance is found in very small amounts in the soil. Plants and animals are the main sources of organic matter. Minerals are an important element of the soil. These are solid components composed of atoms. These occur naturally and have a fixed chemical composition. Olivine and feldspar are the main minerals present in the soil.

The drainage of a soil is an important characteristic to assess, as many plants prefer well-drained soils.

If a soil is poorly drained, sufficient oxygen cannot get to the plant roots, which can stunt or kill the plant.

Soils that are very well drained can limit plant capture of water in drier environments or in dry years due to insufficient water holding capacity.

The texture of soil is a property which is determined largely by the relative proportions of inorganic particles of different sizes.

The fertile soil helps in the growth and development ofthe plants. The plants thus produced are healthy and provide food, clothing, furniture, and medicines.

II. EXPERIMENTAL SECTION

Grinding and sieving of soil samples

Thorough mixing requires that the sample be crushed and ground to particles of uniform size. After drying the sample, clods and large aggregates are crushed and mixed. Then the crushed material is further ground to pass 2 mm sieve. Care should be taken not to break the individual soil particles during the grinding process.

Soil aggregates can be crushed by using jaw crushers, hardened steel mortars or rocking boards (Tan, 1996). Jaw crushers are used for crushing large aggregates, steel mortars for smaller aggregates, and rocking boards for small aggregates.

After grinding, the soil is sieved through a 2 mm sieve and stored in air tight glass or clean plastic containers as soon as possible to avoid adsorption of gases in the laboratory. Then, samples should be stored in a cool and well-ventilated room.

pH

Take 15g of soil sample. Add 37.5ml distilled water. Stir well using glass rod. Cover it with aluminium foil and keep it in mechanical shaker for about 30 mins. After shaker filter and collect the liquid. Liquid is used to analysis the pH.

Sulphate

Weigh 5 g of soil into a 100 ml polyethylene centrifuge tube, add 50 $Ca(H_2PO_4)_2$ solution, and shake the mixture for 30 minutes on a mechanical shaker. Filter into 50 ml volumetric flask. Pipette 5 ml of the extract into a 50 ml volumetric flask, add 5 ml of acetic acid, 1 ml of H_3PO_4 and 1 g of $BaCl_2$ crystals. The phosphoric acid will decolourise any Fe present in solution. Mix gently by inverting the flask several times. Add 2 ml of gum acacia solution and make up to volume with distilled water. Mix gently again and at 5 +/- 0.5 minutes, measure $BaSO_4$ turbidity with a spectrophotometer at 420 nm.

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Water Holding Capacity

Take 25g of soil sample. Transfer it to the funnel using filter paper no 40/41 and pour the soil sample into it. Add 50ml water to the funnel. Collect the water by using measuring cylinder (50 or 100ml)

Soil Nitrogen

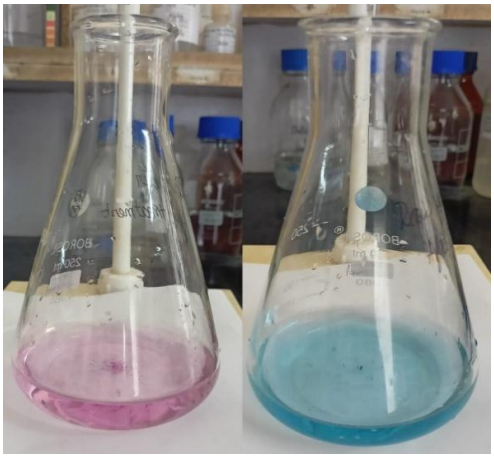
Weigh 10 g of soil (which has been passed through a 20-mesh sieve) and transfer into an 800 ml Kjeldahl flask. Add 50 ml of sulphuric-salicylic acid mixture to the flask and swirl to bring the sample quickly into intimate contact. Allow it to stand overnight. Add 5 g of sodium thiosulphate and heat gently for about 5 minutes, taking care to avoid frothing. Cool the flask, add 10 g of the sulphate mixture and digest on the Kjeldahl apparatus gradually raising the temperature until the digest becomes clear. Digest further at full heat. Cool, add 300 ml of distilled water and mix. Slowly add 100 ml of concentrated sodium hydroxide by letting it run down the neck and settle in the bottom of the flask. Add a large piece of mossy zinc and a spoon of glass beads, connect the flask to the distillation unit, shake by swirling, turn on heat, and distil 150 ml into an Erlenmeyer flask containing 50 ml of 4 percent boric acid solution. Add 10 drops of bromocresol green-methyl red indicator and titrate with the 0.05 M standard sulphuric acid solution to the first faint pink. Titrate a blank prepared in the same manner but without adding a soil sample.

Organic Matter

Grind the soil to pass through 0.5 mm screen, avoiding contact with iron or steel. Transfer a weighed sample, not exceeding 5 g and containing from 10 to 25 mg of organic carbon to a 500 ml wide mouth Erlenmeyer flask. Add 10 ml of 0.1667 M potassium dichromate. Swirl to disperse the soil, then add 20 ml of conc. H_2SO_4.Swirl the flask, insert a thermometer, and heat gently to a temperature of 150°C.. Place the flask on an asbestos pad, and allow to cool to room temperature slowly. Add 200 ml of water and 4 to 5 drops of Ferroin indicator. Titrate with 0.5 M ferrous sulphate until colour changes from green to red.Since some soils adsorb the o-phenanthroline indicator, the titration may be improved by a prior filtration, using a rapid filter paper in a Buchner funnel. In that case, filter after the addition of water and add the indicator to the filtrate. Make a blank determination in the same manner, but without soil, to standardize the reagents. If more than 80% of the dichromate solution is reduced, then the analysis should be repeated with a smaller amount of soil or larger volume of dichromate.

Calcium and Magnesium

Pipette an aliquot (2 - 5 ml) into 50 ml porcelain evaporating dish. Dilute with distilled water to a volume of about 25 ml and add 5 ml of ammonium chloride - ammonium hydroxide buffer solution and 3 to 4 drops of Eriochrome black T indicator. Titrate the contents with 0.01 N EDTA until a sky-blue end point is obtained. Prepare a blank using 2–5 ml distilled water, and follow steps 2 and 3. Express the amount of Ca + Mg in the sample in meq/l.



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III. RESULT AND DISCUSSION

Report No	EHS360/TR/2024-25/N13669N11750	**Report date**	20- 12- 2024
Discipline	Chemical	**Group**	**Pollution and Environment**
Sample name	Soil	**Sample code**	**EHS360/N11750**
Sample description	Soil	**Sampling date**	09-12-2024
Qty. of sample Received	2KG	**Sample receiving date**	09-12-2024
Sample condition	Fit for analysis	**Test commenced on**	10-12-2024
Sampling location	38Th cross street	**Test completed on**	19-12-2024

S.NO.	PARAMETERS	UNIT	TEST METHOD	RESULT
1.	pH value	-	USEPA 3050 B	8.45
2.	Specific Electrical Conductivity	µs/cm	EHS360/Labs/SOP/Soil/001	1170
3.	Sulphate	mg/100g	Food and Agriculture Organisation of the United Nation Rome	
4.	Soil Moisture	%	IS 2720(Part 2)	2.2
5.	Bulk Density	g/cc	Food and Agriculture Organisation of the United Nation Rome	2.0
6.	Soil Nitrogen	%	Food and Agriculture Organisation of the United Nation Rome	0.14
7.	Ammoniacal Nitrogen	mg/kg	Food and Agriculture Organisation of the United Nation Rome	81
8.	Organic Carbon	%	IS 2720(Part 22): 1972	1.4
9.	Organic Matter	%	IS 2720(Part 22): 1972	2.4
10.	Available phosphorous	µg/g	Food and Agriculture Organisation of the United Nation Rome	60
11.	Magnesium	meq/l	Food and Agriculture Organisation of the United Nation Rome	4.0
12.	Calcium	meq/l	Food and Agriculture Organisation of the United Nation Rome	1.4
13.	Chloride	meq/l	Food and Agriculture Organisation of the United Nation Rome	2.5
14.	Carbonate	meq/l	Food and Agriculture Organisation of the United Nation Rome	Nil
15.	Bicarbonate	meq/l	Food and Agriculture	2

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			Organisation of the United Nation Rome	

IV. CONCLUSION

Soil is an important non replenishable natural resource which provides life support, food production, recycling of essential nutrient on earth. Soil sampling and testing can be highly informative for the agronomist and the farmer, improving on farm nutrient efficiency. In this soil sample **EHS360/TR/2024-25/N11750**, was analysed physical, chemical, biological factors. Though, it concludes that this soil sample has efficient nutrients such as Nitrogen, Calcium, Phosphorous, Magnesium and Sulphur to cultivate plants and to construct buildings. The sample which we have taken for analysis **(EHS360/TR/2024-25/N11750)** is Alkaline soil and it is suitable to cultivate plants like Carrot, Broccoli, Cabbage, Brussels sprout, Garlic, Onion, Aloe vera, Celeriac, etc., This Sample contains low range of heavy metals as we have discussed in result and discussion.

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