IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 12, Issue 4, December 2021
Impact Factor: 5.731

Study of Physico-Chemical Parameter of Soil Analysis

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Abstract: *The soil is a mixture of solid, water and gases and also a mixture of minerals, organic matter, gases, liquid and other macro or microorganisms and it performs four important functions. The basic of the status of soil we decide requirement of fertilizer to increase the fertility of the soil. This work examines the principal physical and chemical attributes that can serve as indicators of a change in soil quality under particular agro-climatic condition. You will find that different soil can vary greatly in their composition. Proposed indicator including soil depth to a root restricting layer, water holding capacity, organic matter, N, P, K, Cl, electrical conductivity, moisture content. We also confirmed the justification for selecting these key attributes, their measurement, critical limit for monitoring change in solid productivity and soil quality and crop growth in that soil.*

Keywords: Physico-Chemical Parameter

I. Introduction

Soil is a complex collection of Organic and Inorganic matter. Soil is called the *layer of the Earth* and invove lithosphere, hydrosphere, atmosphere & biosphere. *pedolith*, used to prefer to the soil, content translates *ground stone*. it consists of a solid phase of minerals, organic matter, and porous phase that holds the soil moisture with water. respectively, soils are often treated as system of solids, liquids, and gases.

Soils are Consist of mineral and organic particles of various sizes. The particles are associated in a matrix with results in about 50% porous; it is filling up with water and air. This will prepare a three-phase system of solids, liquids, and gases, all uses of soils are greatly affected by physical properties.

Plants need certain *nutrient elements* to complete their life cycle. No element can substitute for the same.16 elements are essential for the growth of most vascular plants. Carbon, hydrogen, and oxygen are combined in photosynthesis reactions and are obtained from air and water. These three elements compose 90 % of the dry matter of plants. The remaining is obtained largely from the soil and is referred to as the *macronutrients.*

II. Factors and Processes

- This is accomplished by disintegration & decomposition
- It is related with the action of Soil Factors

2.1 Factors

The soils develop as a result of the action of soil forming factors

S = f (P, Cl, O R, P, T)

Further, Jenny (1941) formulated the following equation

Where, Cl – environmental climate
O – Organisms and vegetation (biosphere)
R – Relief or topography
P – Parent material
T- Time

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III. METHODOLOGY

3.1 Area of Study

Kelwad village is situated on the Chikhali Buldana road. There is more forestry area around the village. It is about 35 k.m. away from Buldana in Chikhli Tehsil dist. Buldana. Buldana is one of the five Districts of Amravati division of Vidhrabh region of Maharashtra near satpuda mount.

Mostly Agriculture crop is found in kelwad village is as follows Jawar, chili, wheat, soybean but now a day's mostly soyabin crops , out of these cotton is one of the most important crop in Kelwad village

Various type of soil is present in Dasala

1. Lime soil
2. Black cotton soil
3. Red soil…..etc.

The collected soil samples analysis kit platform available in Laboratory of U.G. Department of Chemistry, Jijamata Mahavidyalaya, Buldana using standard methods available in the literature.

Ten soil samples are proposed to collect from the farms of following farmers at Kelwad village.

Sr. No.	Name of Farmer	Source
1	Prakash Pundlik Lahane	Farm
2	Jayant Anurag Jadhav	Farm
3	Rajaram Gajanan Gawai	Farm
4	Devidas Totaram Jatol	Farm
5	Sanjay Vitthal Patil	Farm
6	Sk. Ganim sk. Alim	Farm
7	Sunil Ganesh Gadekar	Farm
8	Haridas Punjaji Sole	Farm
9	Vilasrao Sheshrao Bahekar	Farm
10	Damodar Arjun Patil	Farm

Procedure and Calculation of following pH

Procedure:

Extraction

1. Add 20 ml distilled water to 8 g air-dried sample in a beaker Take the suspension temperature.
2. Stir at regular intervals for 20-30 minutes.
3. Use pH meter electrode with distilled water.
4. Open the switch, wait for 5 minutes then adjust temperature to room temperature.

Measurement

1. Wash the electrode with distilled water.
2. Record the pH value of the soil suspension.

3.2 Electrical Conductivity (EC)

This is commonly used for measuring the electrical resistance in the solution this will indicates the total concentration of ionized constituents in solutions. Which is closely related to the sum of the cations and anions in the suspension? It used for indicate salinity in soil. Electric conductivity can be expressed as cm in 11:215 soil/water extract.

3.3 Reagents

KCl solution 0.01N: Dissolve 0.7456 g of dry KCl in distilled water and make to 1 L at 25°C. This is a std. reference solution, which at 25oC has an E.C. of 141118 × 10^{-6} (0.0014118) mhos/cm or 11.4118 m mhos/cm.

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Where: V = Volume 0.01 N silver nitrate and titrate.
B = Blank titration volume (ml),
R = Ratio between total volume of the extract and extract volume used for titration, N = Normality of $AgNO_3$ solution,
Wt = Weight of air-dry soil (g)

3.4 Water Holding Capacity

Apparatus and Reagents

Whatmann's filter paper, soil analysis kit, cylinder, measuring beaker, funnel conical flask, Weight balance, Distil water, etc.

Procedure

1. Weight accurately 20 gm of soil sample on the balance
2. Then transfer this soil on the Whatman's filter paper and kept this soil in funnel then on the measuring cylinder
3. Then accurately pour 40 ml of water into the soil sample (which kept on filter paper in funnel)
4. Keep this experiment stay for one night
5. Then observe how much of water is come down from soil sample in measuring cylinder
6. Then accurately weight the wet soil with filter paper
7. Then subtract weight of filter paper from wet soil
8. Then calculate the water holding capacity by the using below formula

WHC = [weight of wet soil – weight of taken soil]

3.5 Moisture Content

Principle:

Hygroscopic water of air-dry soil is determined by heating in an oven at 105°C.

Apparatus:

1. Electric oven with thermostat.
2. Desiccators with siccative.

Procedure:

1. Weigh 5.00 g of air-dry soil < 2 mm into a previously dried (at 105°C) and weighed weighing- dish with lid (a labeled aluminum dish).
2. Dry in an oven at 105°C with unfitted lid over-night.
3. Remove from oven, fit lid, cool in a desiccators for at least 30 minutes and reweigh. All weighing should be recorded to 3 decimal places.

Calculation:

$$\% \text{ moisture} = \frac{wetsoil(g) - Drysoil\backslash(g)}{drysoil} \times 100$$

3.6 Soil Organic Matter: Walkley-Black Method

Equipment:

1. 500- ml Erlenmeyer flasks.
2. 10 ml pipette.
3. 10 and 20 ml dispensers.
4. 50 ml burette.
5. Analytical balance.
6. Magnetic stirrer.

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Reagents:

1. H_3PO_4 85%
2. H_2SO_4 concentrated (96%)
3. NaF, solid
4. Standard 1.00 N $K_2Cr_2O_7$
5. 0.5 N Fe^{++} solution: Dissolve 1.961g of Fe(NH_4)$_2$(SO_4)$_2$. 6 H_2O in 800 ml of water containing 20 ml of concentrated H_2So_4 and dilute to liter. The Fe^{++} in this solution oxidizes slowly on exposure to air so it must be standardized against the dichromate daily.
6. Ferroin indicator: Dissolve 3.71 g of O-phenanthroline and 1.74 g of $FeSO_4$. $7H_2O$ in 250 ml of water.

Procedure:

1. Weigh out 01.0 to 2.00 dried soil (< 60mesh) and transfer to a 500 ml Erlenmeyer flask. The sample should contain 10 to 25 mg of organic C (17 to 43 mg organic matter). For a 1 g sample, this would be 1.2 to 4.3% organic matter. Use up to 2.0 g of sample for light colored soils and 0.1 g for organic soils.
2. Add 10 ml of 1 N $K_2Cr_2O_7$ by means of a pipette.
3. Add 200 ml of concentrated H_2SO_4 by means of dispenser and swirl gently to mix. Avoid excessive swirling that would result in organic particles adhering to the sides of the flask out of the solution.
4. Allow to stand 30 minutes. The flasks should be placed on an asbestos sheet during this time to avoid rapid loss of heat.
5. Dilute the suspension with about 200 ml of water to provide a clearer suspension for viewing the endpoint.
6. Add 10 ml of 85% H_3PO_4, using a suitable dispenser, and 0.2 g of NaF, using the "calibrated spatula" technique. The H_3PO_4 and NaF are added to complex Fe^{3+}, which would interfere with the titration endpoint.
7. Add 10 drops of ferroin indicator. The indicator should be added just prior to titration to avoid deactivation of adsorption onto clay surfaces.
8. Titrate with 0.5 N Fe^{++} to a burgundy endpoint. The color of the solution at the beginning is yellow-orange to dark green, depending on the amount of the unreacted Cr^{++}remaining, which shifts to a turbid gray before the endpoint and then changes sharply to awine red at the endpoint. Use of a magnetic stirrer with an incandescent light makes the endpoint easier to see in the turbid system. (Fluorescent lighting gives a different endpoint color). If less than 5 ml of Fe^{++} solution was required to backtitrate the excess Cr^{++} , there was insufficient Cr^{++} present, and theanalysis should be repeated either by using a smaller sample size or doubling the amount of $K_2Cr_2O_7$ and H_2SO_4. Alternatively use a Pt electrode to determine the endpoint afterstep 5 above. This will eliminate uncertainty in determining the endpoint by color change.
9. Run a reagent blank following the above procedure without soil. The reagent blank is used to standardize the Fe^{++} solution daily.
10. Calculate % C and % organic matter:
    a. % easily oxidizable organic C

$$C = \frac{(B-s)\times n \times Fe++}{gmofsoil} \times \frac{12}{4000} \times 100$$

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IV. RESULT

The physical, chemical properties and all parameters of the collected soil sample from the various farms are discussed below: (F = soil sample in farm)

Farm / P.m.	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
water Holding Capacity	8.9	0.6	10.15	2.11	10	10.1	5.5	11.2	10.5	9.1
pH	7.2 (26^0C)	6.76 (24^0C)	6.90 (25^0C)	7.2 (26^0C)	6.73 (23^0C)	7.3 (22^0C)	6.82 (26^0C)	6.92 (25^0C)	6.43 (24^0C)	7.23 (25^0)c
Electrical conductivity ms^{-1}	0.517	0.419	0.519	0.215	0.275	0.529	0.129	0.320	0.512	0.215
Moisture Contain %	4.3	3.5	2.09	1.0	2.05	4.2	4.3	3.21	4.2	4.5
Organic Carbon %	2.3	1.8	1.6	1.40	1.50	1.33	2.28	1.70	2.50	2.40
Soil texture % 1. Sand	16	16	20	20	25	20	15	10	9	16
2. Slit	32	36	30	30	30	30	30	40	43	37
3. Clay	52	52	50	50	55	50	45	50	52	53

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