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# Assessment of Agricultural Soil Quality of village Sav Tehsil & District Buldana

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**Soil** is the mixture of minerals, organic matter, gases and countless Organisms that together support plant life. Two general classes are topsoil and subsoil. Soil is a natural body that exists as part of the pedosphere and which performs four important functions: it is a medium for plant growth; it is a means of water storage, supply and purification; it is a modifier of the atmosphere of Earth; and it is a habitat for organisms all of which modify the soil. Soil is the end product of the influence of the climate, relief (elevation, orientation, and slope of terrain), organisms, and parent materials (original minerals) interacting over time.6 Soil continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering with associated erosion. Most soils have a density between 1 and 2 gram per cubic centimeter. Soil is a major component of the Earth's ecosystem. The world's ecosystems are impacted in far-reaching ways by the processes carried out in the soil, from ozone depletion and global warming, to rain forest destruction and water pollution. Soil is the largest surficial global carbon reservoir on Earth, and it is potentially one of the most reactive to human disturbance and climate change. As the planet warms, soils will add carbon dioxide to the atmosphere due to its increased biological activity at higher temperatures. Thus, soil carbon losses likely have a large positive feedback response to global warming.

**Key words**: Soil sample collection, soil analysis and its parameter

**Introduction:**

Soil is a complex collection of Organic and Inorganic matter. Soil is called the *Skin of the Earth*[1] and interfaces with the lithosphere, the hydrosphere, the atmosphere, and the biosphere.[2] The term *pedolith*, used commonly to refer to the soil, literally translates *ground stone*. Soil consists of a solid phase of minerals (the soil matrix) and organic matter, as well as a porous phase that holds gases (the soil atmosphere) and water (the soil solution).[3][4][5] Accordingly, soils are often treated as a three-state system of solids, liquids, and gases.[6]

Physically, soils are composed of mineral and organic particles of varying size. The particles are arranged in a matrix that results in about 50 per-cent pore space, which is occupied by water and air. This produces a three-phase system of solids, liquids, and gases. Essentially, all uses of soils are greatly affected by certain physical properties. [7]

Plants need certain *essential nutrient elements* to complete their life cycle. No other element can completely substitute for these elements. At least16 elements are currently considered essential for the growth of most vascular plants. Carbon, hydrogen, and oxygen are combined in photosynthetic reactions and are obtained

from air and water. These three elements compose 90 percent or more of the dry matter of plants. The remaining 13 elements are obtained largely from the soil. Nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) are required in relatively large amounts and are referred to as the *macronutrients.* Elements required in considerably smaller amount are called the *micronutrients.* They include boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Zn). Cobalt (Co).

**Sample collection**

***Area of study:-*** Sav village is situated on the Buldana road. It is about 8 km. away from Buldana. Dist. Buldana.

Buldana is one of the five Districts of Amravati divisions of Vidharbha region of Maharashtra. Mostly Agriculture crop is found in Sav village is as follows Jawar, chili, wheat, soybean, cotton, but cotton is one of the most important crops in Sav village.

***Various type of soil is present in*** Sav

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

**4) Ten soil samples are collected from the farms of following farmers at Sav 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* |

## Materials and Methods

**pH**

**Procedure:**

**Extraction:**

**1-** Add 25 ml distilled water to 10 g air-dried sample in a beaker 50 ml. Read the suspension temperature by thermometer.

**2-** Stir at regular intervals for 20-30 minutes.

**3-** Wash the pH meter electrode with distilled water.

**4-** Open the contact switch, wait 5 minutes, adjust temperature knob to room temperature.

**Measurement:**

**5-** Rinse the electrode with distilled water, then with the soil suspension after stirring.

**6-** Read the pH value of the soil suspension.

**ELECTRICAL CONDUCTIVITY (EC)**

**Procedures:**

**Extraction:**

**1-** Put 10 g air-dry soil in 100 ml beaker, add 25 ml distilled water.

**2-** Stirr for 10 minutes, repeat stirring 4 times on 30 minutes intervals.

**3-** Measure the suspension temperature by thermometer.

**Operation:**

Before measuring, rise and fill the cell with reagent.

**1-** Set the temperature compensation dial.

**2-** Open the contact switch, wait for 5 minutes.

**3-** Balance the bridge with the main dial.

**TOTAL NITROGEN**

***Procedure:***

**Digestion:**

**1-** Weigh 5 g soil into digestion flask.

**2-** Add 5 g digestion mixture and 20 ml $H_2SO_4$ conc.

**3-** Put the flask on digestion board with electric heaters. Heat gradually; low at 10-30 minutes, then raise heating degree.

**4-** After the end of fuming, the digestion is continued for 1 hour after the solution had cleared with white color of digestion mixture.

**5-** Transfer the sample to 250 ml volumetric flask, complete the volume with dist. Water.

**Distillation:**

**6-** Put 20 ml $H_3BO_3$ in Erlenmeyer flask and 4 drops of the indicator.

Put the flask so that the lower tip of the glass receiver tube is below the boric acid surface.

**7-** Start running the cooling water in condenser

**8-** Start boiling the water in the boilers.

**9-** Put 25 ml of the sample in the funnel with dist. Water. Released ammonia is trapped in boric acid.

**Titration:**

**10-** Ammonia is titrated with HCl or $H_2SO_4$. At end point the green color just disappears.

**Calculation**

$$\text{N \% in soil} = \frac{(sample\ titration - blank) \times normality \times 14 \times dilution}{sample\ weight}$$

***SOIL ORGANIC MATTER: WALKLEY-BLACK METHOD***

***Procedure:***

**1** Weigh out 01.0 to 2.00 dried soil (< 60 mesh) 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 a wine red at the endpoint. Use of a magnetic stirrer with an incandescent light makes the end point 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 back titrate the excess $Cr^{++}$ , there was

insufficient $Cr^{++}$ present, and the analysis 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 after step 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

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

Where:

B = ml of $Fe^{++}$ solution used to titrate blank,

S = ml of $Fe^{++}$ solution used to titrate sample,

And 12/ 4000 = m equivalent

**Result**

***The physical, chemical properties and all parameters of the collected soil sample from the various farms are discuss 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 ($26^0$ C)* | *6.76 ($24^0$ C)* | *6.90 ($25^0$ C)* | *7.2 ($26^0$ C)* | *6.73 ($23^0$C )* | *7.3 ($22^0$ C)* | *6.82 ($26^0$ C)* | *6.92 ($25^0$ C)* | *6.43 ($24^0$C)* | *7.23 ($25^0$)c* |
| ***Nitrogen ( % )*** | *3.23* | *3.44* | *3.2* | *4.30* | *3.54* | *3.24* | *2.46* | *3.50* | *3.1* | *3* |
| ***Chloride (%)*** | *0.07* | *0.057* | *0.07* | *0.50* | *0.13* | *0.31* | *0.072* | *0.08* | *0.074* | *0.05* |
| ***Magnesium (%)*** | *3.3* | *3.23* | *3.23* | *3.24* | *3.30* | *2.50* | *1.49* | *2.23* | *3.21* | *2.3* |
| ***Electrical conductivity $ms^{-1}$*** | *0.517* | *0.419* | *0.519* | *0.215* | *0.275* | *0.529* | *0.129* | *0.320* | *0.512* | *0.215* |

**Discussion**

**Reference Tables:**

**Based on the pH value of the following ratings may be adopted.**

| S.N. | Rating | pH range | Characteristics |
|---|---|---|---|
| 1 | Extremely alkaline | >9.0 | Characteristic of highly alkaline soils requiring reclamation measures. |
| 2 | Strongly alkaline | 8.4-9.0 | |
| 3 | Moderate alkaline | 7.6-8.3 | Suitable for many crops. pH beyond 8 to 8.3 can be tolerated by crops like rice, Lucerne. |
| 4 | Slightly alkaline | 7.1-7.5 | |
| 5 | Nearly alkaline | 6.5-7.0 | |
| 6 | Slightly acidic | 6.0-6.5 | Characteristic of much red and lateritic soil indicating deficiency of calcium and low in base saturation. |
| 7 | Moderate acidic | 5.3-6.0 | |
| 8 | Strongly acidic | 4.5-5.2 | Characteristic of soil of the humid regions where annual rainfall exceeds 18 inches. |
| 9 | Extremely acidic | >4.5 | |

**Categorization of soil on the basis of Electrical conductivity:**

| **Electrical conductivity (ds/m)** | **Rating** |
|---|---|
| <1 | Good soil |
| 1.00-2.00 | Poor seed germination |
| 2.00-3.00 | Harmful for some crop like pulses |
| >3 | Harmful for most of the crops |

**Rating of soil in 6 tier system on the basis of organic carbon.**

| **Sr.No.** | **Rating** | **Organic carbon content %** |
|---|---|---|
| 1 | Very low | Less than 0.20 |
| 2 | Low | 0.21 to 0.40 |
| 3 | Moderate | 0.41 to 0.60 |
| 4 | Moderately high | 0.61 to 0.80 |
| 5 | High | 0.81 to 1.00 |
| 6 | Very high | Greater than 1.00 |

**Soil categorization on the basis of Nitrogen, Phosphorus and Potassium content [18]**

| Sr. No. | Element | Required range |
|---|---|---|
| 1 | Nitrogen | 3-5% |
| 2 | Magnesium | 5-10% |
| 3 | Chloride | 12-15% |

**Conclusion**

After collecting the soil sample from Sav village, Buldana District in observed all the parameters i.e. N, P, & Cl water holding properties, pH, organic carbon , as composition it is concluded that all the parameter are in the good health but pH holder show the slightly acidic in nature .Electrically conductivity indicates good soil.

From the study of calcium carbonate, it is indicated that the soil is slightly calcareous and from the percentage of calcium carbonate it is concluded that the $CaC0_3$ is present is less amount which is good for the soil. If it is present in excess it may affect the crop.

Organic carbon determination shows the carbon content is high. It is beneficial for supplying water to plants and also by providing the good physical condition to the soil. Farmers are requested to not use the large quantity of organic carbon containing fertilizer because which is present in sufficient amount.

From N, P, K studies it is observed that all the parameter is in the required range which indicates that the soil is good for the Soybean, Harbhara, Tur crop and also for oranges and lemon crops.

Farmers are suggested that to do not use much fertilizer because the farm is rich with all the nutrient and excess of fertilizer may decrease the crop yield.

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