Physico-Chemical Analysis of Soil Samples of Shivamogga District of Karnataka State

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Abstract: Soil is a natural body of minerals and organic material differentiated into horizons, which differ among themselves as well as from underlying materials in their morphology, physical make-up, chemical composition and biological characteristics. In the present study, soil samples collected randomly from all the taluks of shivamogga district and from each taluk five representative locations is selected for analysis. Physical parameters like pH, Electrical Conductivity (EC), Color and chemical parameters like Nitrogen, Phosphorous, Potassium (N+P+K), Sulphur, Boron, Copper, Iron, Manganese, Zinc and Organic Carbon were analyzed.

Keywords: Nutrients, electrical conductivity, pH and Colour.

1. Introduction

Soil sample analysis of a region is a major factor in determining what types of plants grow in a certain area. Soil is a dynamic medium made up of minerals, organic matter, water and air. Soil characterization of a region is an important aspect in relation to sustainable agriculture production. The chemical macro (N,P,K) and micro nutrients (S,B,Cu,Mg,Fe,Al) and physical parameters like PH, EC, OC and colour are important soil elements that control its fertility and enhances the yields of crops. And, if we fail to supply proper nutrients in proper concentrations, plant function is affected.

Shivamogga district is one of the district of Karnataka state in southern India, with a total area of 8465 km². The two major rivers that flow through this district are Tunga and Bhadra. Shivamogga receives an average annual rainfall of 1813.9 mm with an average of 86 days in the year being rainy days. A major part of shivamogga district, lies in the malnad region of the Western Ghats and it is treated as the “Gateway to Malnad” or ‘Malenaada Hebbagilu’.

The information about availability of macro and micro nutrients of chosen study area is meagre. Thus, our aid in this study was to know the Physico-chemical parameters of soils of the Shivamogga district, and their probable influence on crop yield. The author has made similar studies on soil samples from drought affected area of Chitradurga district of Karnataka State [1].

2. Methods

The study area covered all taluks of shivamogga district, comprising of Five villages each. From Shivamogga taluk: Abbal agree (S1), Buddigere colony (S2), Tyjavalli (S3), Yadavalla (S4), and Verragarana Byranakoppa (S5). From Bhadravathi taluk: Majjegeanahalli (S6), Belakkithanda (S7), Kaddadakatti (S8), Huliyaru Ramannakoppa (S9), and Shankalipura (S10). From Thirthahalli taluk: Tuduru (S11), Kudu mallige (S12), Shankaramanne (S13), Halige Kattikopa (S14) and Kodlu (S15). From Shikaripura taluk, Attibyalu (S16), HariGupa circle (S17), Bendikatti (S18), Begur (S19), and Muddanahalli (S20). From Soraraba taluk, Belavanne (S21), Koddikanni (S22), Jolladha Gudi (S23), Guddavi (S24), and Thavarahalli (S25). From Sagar taluk, chikkanalur (S26), Keladi (S27), Balleshe Goda (S28), Hyggena bylu (S29), and Ahachapura (S30). From Hosanagar taluk Sudurugate (S31), Ripanpete (S32), Mudguthi (S33), Herijanni (S34), and Koduru (S35). Soil samples were collected from each village and composite soil samples (depth 0-15 cm) were prepared, air dried and processed to pass through 2mm sieve and analyzed for the color of the soil using munsell chart. The pH, EC, macro-nutrients, S, B and OC were analyzed as per methods standardized by Krishi Vigyana Kendra [2], an institution affiliated to university of agricultural sciences, Bangalore, situated at Navile, shivamogga. Micronutrients were analyzed by atomic absorption Spectroscopic (AAS) technique in the soil test laboratory, O.T Road, shivamogga. The comparative trend of the data is tabulated (Table-1 & 2) and plotted (Figures 1-12).

3. Results

Soil pH and Electrical Conductivity

According to classification of soil reaction suggested by [3]. Twenty six samples were neutral (pH 6.6 to 7.3), Six of them were mildly alkaline (pH 7.4 to 8.0) and Two sample moderately alkaline (pH 7.9 to 8.1), and Three Samples were slightly acidic in nature (pH less than 6.6). The soil pH varied from 6.55 to 7.96 with an average of 7.00 (Table-2). The data presented in (Table-2, Figure 1).
Figure 1: Variation of PH with Places

The amount of available nitrogen in Sagar taluk is minimum, which is due to low amount of organic carbon. Maximum amount of nitrogen found in Shikaripura taluk and is due to high amount organic carbon in the soils. In most of the soils, the available nitrogen is found to be in organic form. It could be recalled that the presence of nitrogen enhances plant growth, quality of yield, seed and fruit production.

Phosphorus: Further, the data from Table-1 show the available phosphorus content varying from 11 to 695 kg ha⁻¹ with an mean value of 182.82 kg ha⁻¹. The data show a lower phosphorus content in one soil sample. Four samples has medium phosphorus content and thirty soil samples have excess phosphorus content. Minimum and maximum amounts of Phosphorus were found in Thirthahalli taluk and Shikaripura taluk respectively (Table-2- Figure 4). Phosphorus improves root development, rapid growth and encourages blooming.

Figure 4: Variation of P₂O₅ with Places

Potassium: Table-1 further elucidates the available potassium status varied from 100 to 343 kg ha⁻¹, with an average of 201.50 kg ha⁻¹. The available potassium content is high in four soil samples. The available potassium content is low in ten soil samples. The available potassium content is medium in twenty one soil samples.

The minimum Potassium content is found in Soraba taluk and maximum Potassium is found in Shikaripura taluk (Table-2- figure 5). The potassium content present in the soil depends on favorable soil environment with the presence of organic matter [8]. The potassium is used to build proteins.

Figure 5: Variation of K₂O with Places

Sulphur: The data represented in Table-1 shows the available Sulphur status and varies from 2 to 94 ppm with the amount of available nitrogen in Sagar taluk is minimum, which is due to low amount of organic carbon. Maximum amount of nitrogen found in Shikaripura taluk and is due to high amount organic carbon in the soils. In most of the soils, the available nitrogen is found to be in organic form. It could be recalled that the presence of nitrogen enhances plant growth, quality of yield, seed and fruit production.

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mean value of 13.97 ppm. Twenty one soil samples have low sulphur content. Six soil samples have medium sulphur content. Eight soil samples have high sulphur content. Soraba taluk has minimum sulphur content and Thirthahalli taluk has maximum sulphur content (Table-2, figure 6).

**Figure 6: Variation of S with Places**

**Boron:** The data tabulated (Table-1) shows the available Boron status and is varied from 1 to 6 ppm with mean value of 2.074 ppm. All the soil samples have high Boron content. Shivamogga taluk has minimum Boron content and Soraba taluk has maximum Boron content (Table-2 and figure 7).

**Figure 7: Variation of B with Places**

**Zinc:** The data in (Table-1) shows the available Zinc status, which varies from 0.49 to 3.74 ppm with a mean value of 1.56 ppm. Two soil samples have low Zinc content. Twelve soil samples have medium Zinc content. Twenty one soil samples have high Zinc content. Sagar taluk has minimum Zinc content and Shikaripura taluk has maximum Zinc content (Table-2, figure 8).

**Figure 8: Variation of Zn with Places**

**Iron:** Table-1 shows the available iron status varying between 5.36 to 59.40 ppm with an average value of 34.074 ppm. Five soil samples were found normal status (<9 ppm) and thirty soil samples were found to be excess status of iron content. Shikaripura taluk has minimum value of iron content and Soraba taluk has maximum value of Iron content. (see Table-2, figure 9).

**Figure 9: Variation of Fe with Places**

**Manganese:** The Table-1 shows the available manganese status which varies from 5.17 to 266 ppm with a mean value of 49.44 ppm, and all the soil samples have high value of manganese. Minimum value of manganese status is in Hosanagara taluk and Shivamogga taluk has a maximum value of Manganese (Table-2, figure 10).

**Figure 10: Variation of Mn with Places**

**Copper:** The data shows (Table-1) the availability of copper and is found to vary from 0.84 to 6.31 ppm with a mean value of 2.79 ppm, and all the soil samples have high value of copper content. Shikaripura taluk has a minimum value of copper content and Soraba taluk has a maximum value of copper content. (Table-2, Figure 11).

**Figure 11: Variation of Cu with Places**
Organic carbon: Table-1 shows the Organic carbon content ranged from 0.12 to 3.22% with an average of 1.569 %. Seven soil samples (< 0.5%) have low organic carbon content, and One soil sample (0.5-0.75) has medium organic carbon content. Twenty seven soil samples has Excess organic carbon content. As represented in (Table-2, figure 12) maximum amount of OC is found in Shikaripura taluk and minimum amount of OC was found in Hosanagara taluk. The deficiency in organic carbon due to high temperature and good aeration in the soil which increases the rate of oxidation of organic matter [8].

4. Conclusion

From this study we conclude that the pH, EC, colour, macro and micro nutrients of all taluks of Shivamogga district are within permissible limits and therefore the soil seems to be suitable for both agricultural, horticultural crops and medical plants. Color of soil samples was indicative of Organic matter in the soil and helps soil character analysis.

5. Acknowledgement

The authors are also thankful to UGC for the sanction of teacher fellowship under Faculty Development Programme (XI plan). The authors are also thankful to Dr. Chidanandappa and Dr. Dhananjaya of Agricultural college, Navule, Shivamogga, for their constant support during the experimental work. We express our sincere gratitude to the Director and staff members soil test laboratory O.T. Road, Shivamogga, for extending valuable support during the measurements contained in the paper.

References


Table 1: Physico-Chemical properties and Macro and Micro nutrient status of soil samples under study

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Taluk</th>
<th>PH</th>
<th>EC (ds m⁻¹)</th>
<th>N (kg ha⁻¹)</th>
<th>P₃O₅ (kg ha⁻¹)</th>
<th>K₂O (kg ha⁻¹)</th>
<th>S (ppm)</th>
<th>B (ppm)</th>
<th>Zn (ppm)</th>
<th>Fe (ppm)</th>
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Table 2: Average values of Physico-Chemical properties and Macro and Micro nutrient status

<table>
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<tr>
<th>Sample no</th>
<th>Taluks</th>
<th>PH EC dsm⁻¹</th>
<th>N Kg/ha</th>
<th>P₂O₅ Kg/ha</th>
<th>K₂O Kg/ha</th>
<th>Sulphur (S) Ppm</th>
<th>Boran B Ppm</th>
<th>Zn Ppm</th>
<th>Fe Ppm</th>
<th>Mn Ppm</th>
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Sulphur (S) Kg/ha: 1.26 - 2.15
Boran B Ppm: 1.16 - 1.29
Zn Ppm: 0.87 - 1.19
Fe Ppm: 4.31 - 5.16
Mn Ppm: 10.57 - 11.63
Cu Ppm: 1.73 - 1.75

Chemical properties and Macro and Micro nutrient status