A COMPARATIVE STUDY ON THE PHYSICO-CHEMICAL PARAMETERS OF THE SOILS OF CHITRADURGA DISTRICT, KARNATAKA

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ABSTRACT

The physico-chemical study of soil is based on various parameters like color, pH, Electrical Conductivity (EC) and status of available total primary macronutrients (N+P+K), status of Sulphur (S), Organic Carbon (OC) and total micro-nutrients (Cu+Fe+Mn+Zn). Soil fertility identification of a region plays an important role in the context of sustainable agricultural production. The proper proportions of primary macronutrients, micronutrients present in the soil represents the fertility status which helps to control the yield of crops. The Chitradurga district of Karnataka was selected for the study. The soil samples (depth 0-15cm) were collected randomly in all the taluks of Chitradurga district and compared for their physico-chemical properties. These results help agronomists, agriculture engineers and farmers for finding the problems related to soil, nature and nutrient status and improve the sustainable agricultural production.

KEYWORDS : pH, Electrical conductivity, Macronutrients, Micronutrients, Soil color

Soil fertility is the inherent capacity of the soil to provide the essential plant nutrients in adequate amounts and in proper proportions for the plant growth (Rajan kumar Basak, 2012). Soil characterization of a region is an important aspect in relation to sustainable agricultural production. The macronutrients and micronutrients are important soil elements that control its fertility and enhances the yield of crops (Singh, 2012). If we fail to supply the proper nutrients in the proper concentrations, the plant function is affected. The aim of this study was to know the physico-chemical parameters of soils of various taluks of Chitradurga district, and also an attempt is made to compare the micro and macronutrient contents of the soil.

Chitradurga is one of the districts of Karnataka state in southern India, spanning an area of 8,440 Sq. km. The whole district lies in the valley of the Vedavathi river with the thungabhadra river flowing in the northwest. It receives low to moderate rain fall and is one of the drought prone districts in the state, which is described locally as Bayalusceme.

MATERIALS AND METHODS

The study area covers all taluks of Chitradurga district, comprising of three villages each, from Hosadurga taluk namely, Aralahalli (S1), Hunnenodu (S2) and Jodisirampura(S3); Paramanahalli (S4), Gannayakanahalli (S5) and Harthikote (S6) from Hiriyur taluk; Hotteajjanakaple(S7), Chikkamanahalli(S8) and Kurudihalli(S9) from Challakere taluk; Chotoubhayannahatti (S10), Rayapuradhamesarahhatti(S11) and BGkere (S12) from Molakalmur taluk, Dhaddinakurubharafattti (S13), Nayakarasollapura (S14) and Singapura (S15) from Chitrudurga taluk and Holalkere (S16), Gundimadu (S17) and Anjanapura (S18) from Holalkere taluk were selected for the study. Soil samples(depth 0-15cm) were collected randomly in all the taluks of Chitradurga district and compared for their physico-chemical properties.

RESULTS AND DISCUSSION

Soil pH and Electrical Conductivity

According to classification of soil reaction suggested by Brady, 1985, three samples were neutral (pH 6.6 to 7.3), six of them were mildly alkaline (pH 7.4 to 7.8), and seven were moderately alkaline (pH 7.9 to 8.1), couple of them were strongly alkaline (pH 8.5 to 9). The soil pH varied from 6.93 to 8.75 with an average of 7.87 (Table-
The data presented in (table-2- figure 1) represent minimum value of pH 7.44 in Hosadurga taluk and maximum value of pH 8.22 in Hiriyur taluk. The pH of the soil provides information regarding the potency of toxic substances present (Baruch, 1997).

The electrical conductivity of soil samples varied from 0.018 to 0.2 dsm-1 (table 1) with an average of 0.066 dsm-1. On the basis of limits suggested by Muhr et al.,(1965), used for judging salinity of soils, all the samples were found to fall in low conductivity group. Data represented (table-2/figure2) show that Hosadurga taluk has minimum value of conductivity and Chitradurga taluk has maximum value of conductivity. The electrical conductivity may be ascribed to the leaching of salts to lower horizons (Singh, 2012).

**Organic Carbon**

Table 1 shows the the Organic carbon content ranged from 0.22 to 0.49% with an average of 0.32%. The organic carbon content is low in all the soil samples (<0.5%). As represented in table 2 and figure 3 maximum amount of OC is found in Hiriyur taluk and minimum amount OC was found in Hosadurga taluk. All the samples show the deficiency in organic carbon due to high temperature and good aeration in the soil which increases the rate of oxidation of organic matter (Singh 2012).

**Nitrogen**

Table-1 also shows the Nitrogen status varied from 250 to 439 kg ha-1 with an average value of 337 kg ha-1 on the basis of the ratings suggested by Subbiah and Asija, 1956 the available nitrogen was found to be medium in all soil samples. We infer (table 2 and figure 4) that the minimum amount of available nitrogen in Hosadurga taluk and is due to low amount of organic carbon and maximum amount of nitrogen found in Holalkere 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 65 to 337kgha-1 with an mean value of 163 kg ha-1. The data show the status of phosphorus content is high in all the soil samples. Minimum
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</th>
<th>N</th>
<th>P₂O₅</th>
<th>K₂O</th>
<th>S</th>
<th>Zn</th>
<th>Mn</th>
<th>Cu</th>
<th>Fe</th>
<th>OC</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Hosdurga</td>
<td>6.93</td>
<td>0.018</td>
<td>313.60</td>
<td>171.69</td>
<td>160.16</td>
<td>36.71</td>
<td>0.108</td>
<td>5.738</td>
<td>1.538</td>
<td>13.21</td>
<td>0.22</td>
<td>Reddish brown</td>
</tr>
<tr>
<td>S2</td>
<td>Hosdurga</td>
<td>7.54</td>
<td>0.056</td>
<td>250.88</td>
<td>145.90</td>
<td>213.92</td>
<td>32.35</td>
<td>5.748</td>
<td>23.44</td>
<td>1.730</td>
<td>4.404</td>
<td>0.23</td>
<td>Dark Reddish brown</td>
</tr>
<tr>
<td>S3</td>
<td>Hosdurga</td>
<td>7.86</td>
<td>0.058</td>
<td>313.60</td>
<td>144.55</td>
<td>198.24</td>
<td>38.89</td>
<td>5.778</td>
<td>19.34</td>
<td>2.020</td>
<td>4.166</td>
<td>0.31</td>
<td>Dark Red</td>
</tr>
<tr>
<td>S4</td>
<td>Hiriyur</td>
<td>8.11</td>
<td>0.094</td>
<td>376.32</td>
<td>154.05</td>
<td>269.92</td>
<td>19.99</td>
<td>5.508</td>
<td>20.00</td>
<td>2.500</td>
<td>1.072</td>
<td>0.49</td>
<td>Dark Reddish brown</td>
</tr>
<tr>
<td>S5</td>
<td>Hiriyur</td>
<td>7.93</td>
<td>0.057</td>
<td>376.32</td>
<td>65.83</td>
<td>112.00</td>
<td>30.53</td>
<td>5.030</td>
<td>16.39</td>
<td>3.076</td>
<td>8.928</td>
<td>0.42</td>
<td>Dark Reddish brown</td>
</tr>
<tr>
<td>S6</td>
<td>Hiriyur</td>
<td>8.64</td>
<td>0.072</td>
<td>376.32</td>
<td>137.76</td>
<td>160.16</td>
<td>50.89</td>
<td>5.120</td>
<td>11.31</td>
<td>0.674</td>
<td>3.690</td>
<td>0.31</td>
<td>Reddish Black</td>
</tr>
<tr>
<td>S7</td>
<td>Challakere</td>
<td>7.78</td>
<td>0.033</td>
<td>344.96</td>
<td>148.62</td>
<td>240.80</td>
<td>51.62</td>
<td>4.910</td>
<td>25.08</td>
<td>0.962</td>
<td>1.786</td>
<td>0.29</td>
<td>Dark Reddish brown</td>
</tr>
<tr>
<td>S8</td>
<td>Challakere</td>
<td>8.02</td>
<td>0.084</td>
<td>344.96</td>
<td>147.26</td>
<td>198.24</td>
<td>72.70</td>
<td>5.598</td>
<td>39.02</td>
<td>0.770</td>
<td>6.786</td>
<td>0.32</td>
<td>Dull Reddish brown</td>
</tr>
<tr>
<td>S9</td>
<td>Challakere</td>
<td>8.24</td>
<td>0.092</td>
<td>376.32</td>
<td>155.40</td>
<td>234.08</td>
<td>51.98</td>
<td>5.480</td>
<td>15.25</td>
<td>1.058</td>
<td>3.452</td>
<td>0.22</td>
<td>Reddish brown</td>
</tr>
<tr>
<td>S10</td>
<td>Molakalmur</td>
<td>7.86</td>
<td>0.048</td>
<td>439.04</td>
<td>145.90</td>
<td>256.48</td>
<td>52.71</td>
<td>5.748</td>
<td>20.32</td>
<td>1.058</td>
<td>1.786</td>
<td>0.32</td>
<td>Dark Reddish brown</td>
</tr>
<tr>
<td>S11</td>
<td>Molakalmur</td>
<td>7.58</td>
<td>0.026</td>
<td>344.96</td>
<td>133.01</td>
<td>351.68</td>
<td>55.61</td>
<td>6.198</td>
<td>73.94</td>
<td>2.200</td>
<td>7.976</td>
<td>0.31</td>
<td>Dark Reddish brown</td>
</tr>
<tr>
<td>S12</td>
<td>Molakalmur</td>
<td>7.98</td>
<td>0.077</td>
<td>376.32</td>
<td>322.42</td>
<td>238.56</td>
<td>61.43</td>
<td>6.048</td>
<td>61.96</td>
<td>1.154</td>
<td>5.596</td>
<td>0.27</td>
<td>Dull Reddish brown</td>
</tr>
<tr>
<td>S13</td>
<td>Chinthradurga</td>
<td>8.14</td>
<td>0.234</td>
<td>439.04</td>
<td>142.51</td>
<td>300.16</td>
<td>57.43</td>
<td>5.210</td>
<td>16.07</td>
<td>0.770</td>
<td>0.596</td>
<td>0.37</td>
<td>Brownish Black</td>
</tr>
<tr>
<td>S14</td>
<td>Chinthradurga</td>
<td>8.04</td>
<td>0.064</td>
<td>282.24</td>
<td>337.76</td>
<td>192.64</td>
<td>73.24</td>
<td>4.550</td>
<td>14.75</td>
<td>1.826</td>
<td>0.596</td>
<td>0.25</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>S15</td>
<td>Chinthradurga</td>
<td>7.56</td>
<td>0.023</td>
<td>439.04</td>
<td>137.08</td>
<td>228.80</td>
<td>33.08</td>
<td>5.000</td>
<td>35.90</td>
<td>2.692</td>
<td>5.358</td>
<td>0.47</td>
<td>Brown</td>
</tr>
<tr>
<td>S16</td>
<td>Holalkere</td>
<td>7.32</td>
<td>0.041</td>
<td>376.32</td>
<td>152.01</td>
<td>155.68</td>
<td>106.5</td>
<td>5.598</td>
<td>68.36</td>
<td>1.634</td>
<td>8.690</td>
<td>0.25</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>S17</td>
<td>Holalkere</td>
<td>8.75</td>
<td>0.079</td>
<td>439.04</td>
<td>147.26</td>
<td>56.00</td>
<td>51.80</td>
<td>5.508</td>
<td>34.92</td>
<td>0.866</td>
<td>6.548</td>
<td>0.30</td>
<td>Grey Color</td>
</tr>
<tr>
<td>S18</td>
<td>Holalkere</td>
<td>7.35</td>
<td>0.040</td>
<td>439.04</td>
<td>155.40</td>
<td>168.00</td>
<td>42.53</td>
<td>5.060</td>
<td>24.60</td>
<td>1.154</td>
<td>3.214</td>
<td>0.42</td>
<td>Dark Reddish brown</td>
</tr>
</tbody>
</table>
and maximum amounts Phosphorus were found in Hiriyur taluk and Molakalmur taluk respectively (table 2 and figure 5). Phosphorus improves root development, rapid growth and encourages blooming.

Potassium
As table 1 further elucidates the available potassium status varied from 56 to 351 kg ha⁻¹ with an average of 201.97 kg ha⁻¹. The available potassium content is high in all the soil samples except two soil samples (S5 and S17). The minimum Potassium content is found in Holalkere taluk and maximum Potassium is found in Molakalmur taluk (table 2 and figure 6). The potassium content present in the soil depends on favorable soil environment with the presence of organic matter (Chauhan, 2001). The potassium is used to build proteins.

Sulphur
The data represented in Table-1 shows the available Sulphur status and is varied from 19-106 ppm with mean value of 51.11 ppm, all the soil samples have high sulphur content. Hiriyur taluk has minimum sulphur content and Holalkere taluk has maximum sulphur content (Table-2 and figure 7).

Zinc
The data as tabulated (table 1) shows the available Zinc status, which varies from 0.108 to 6.198 ppm with a mean value of 5.12 ppm, and all the soil samples have high Zinc content. Hosadurga taluk has minimum Zinc content and Molakalmur taluk has maximum Zinc content (table 2 and figure 8).

Iron
Table 1 shows the available iron status varying between 1.07 to 13.21 ppm with an average value of 4.89 ppm. 45% of soil samples were found to be deficient (<4.5 ppm) and 50% of soil samples were found under normal status (>4.56 ppm) only 5% of soil samples were found to be of excess status of Iron content (>9 ppm). Chithradurga taluk has minimum value of iron content (<4.5 ppm) and Hosadurga taluk has maximum value of Iron content (>4.5 ppm) (Shivakumar, 2013) (see table 2 and figure 9).

Manganese
The Table-1 shows the available manganese status which varies from 5.73 to 73.94 ppm with a mean value of

![Figure 5: Variation of P₂O₅ with Places](image1)

![Figure 6: Variation of K₂O with Places](image2)

![Figure 7: Variation of S with Places](image3)

![Figure 8: Variation of Zn with Places](image4)
29.24ppm, and all the soil samples have high value of manganese. Minimum value of manganese status is in Hiriyur and Molakalmur taluk has a maximum value of manganese (table 2 and figure 10).

Copper

The data shows (see table-1) the availability of copper and is found to vary from 0.674 to 3.076ppm with a mean value of 1.52ppm. All the soil samples of Chitradurga district are high copper content. Challakere taluk has a minimum copper content and Hiriyur taluk has maximum value of copper in it (table 2 and figure 11).
CONCLUSION

From this study we conclude that the pH, EC, colour, macro and micro nutrients of all taluks of Chitradurga district are within permissible limits and therefore the soil seems to be suitable for both agricultural and horticultural crops.

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