

## 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 Jodisrirampura(S3); Paramenahalli (S4), Gannayakanahalli (S5) and Harthikote (S6) from Hiriyur taluk; Hotteajjanakaple(S7), Chikkamanahalli(S8) and

Kurudihalli(S9) from Challakere taluk ; Chotoubhayanahatti (S10), Rayapuradhamesarahatti(S11) and BGkere (S12) from Molakalmur taluk, Dhaddinakurubharahatti (S13), Nayakarasollapura (S14) and Singapura (S15) from Chitradurga taluk and Holalkere (S16), Gundimadu (S17) and Anjanapura (S18) from Holalkere taluk were selected for the study. Soil samples were collected from each village and composite soil samples (depth 0-15cm) were prepared the soil samples were air dried and processed to pass through 2mm sieve and analyzed for the color of the soil using munsell chart. The pH, EC, macronutrients, S, OC were analyzed as per methods standardized by Krishi Vigyana Kendra, an institution to 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 both tabulated (table 2) and plotted (figures 1-11).

### 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-

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1).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 337kg/ha-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

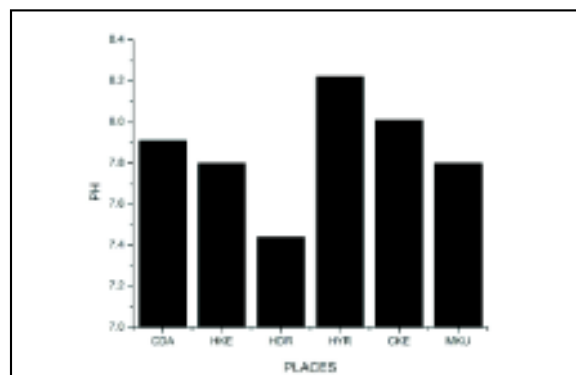


Figure 1: Variation of PH with Places

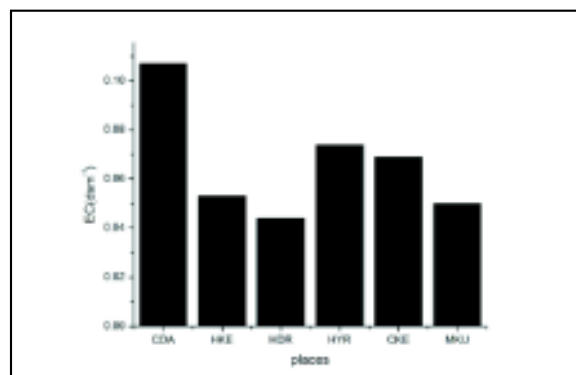


Figure 2: Variation of EC with Places

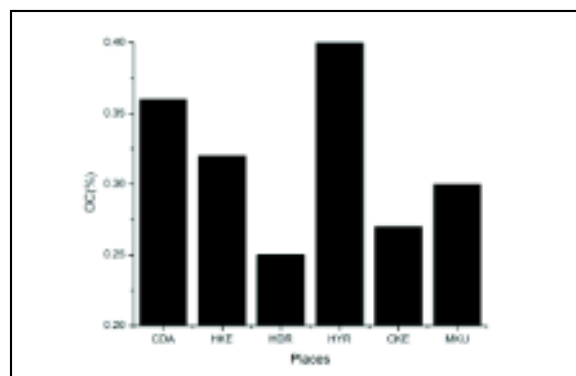


Figure 3: Variation of OC with Places

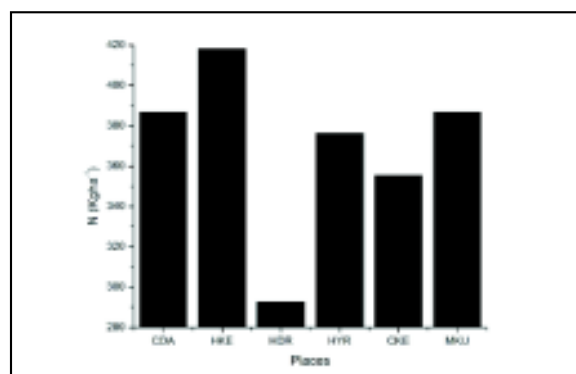


Figure 4: Variation of N with Places

Table 1 : Physico-Chemical Properties and Macro and Micro Nutrient Status of Soil Samples Under Study

Sample No.	Taluk	PH	EC dsm <sup>-1</sup>	N kg/ha <sup>-1</sup>	P <sub>2</sub> O <sub>5</sub> kg/ha <sup>-1</sup>	K <sub>2</sub> O kg/ha <sup>-1</sup>	S ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	OC %	Color
S1	Hosdurga	6.93	0.018	313.60	171.69	160.16	36.71	0.108	5.738	1.538	13.21	0.22	Reddish brown
S2	Hosdurga	7.54	0.056	250.88	145.90	213.92	32.35	5.748	23.44	1.730	4.404	0.23	Dark Reddish brown
S3	Hosdurga	7.86	0.058	313.60	144.55	198.24	38.89	5.778	19.34	2.020	4.166	0.31	Dark Red
S4	Hiriyur	8.11	0.094	376.32	154.05	269.92	19.99	5.508	20.00	2.500	1.072	0.49	Dark Reddish brown
S5	Hiriyur	7.93	0.057	376.32	65.83	112.00	30.53	5.030	16.39	3.076	8.928	0.42	Dark Reddish brown
S6	Hiriyur	8.64	0.072	376.32	137.76	160.16	50.89	5.120	11.31	0.674	3.690	0.31	Reddish Black
S7	Challakere	7.78	0.033	344.96	148.62	240.80	51.62	4.910	25.08	0.962	1.786	0.29	Dark Reddish brown
S8	Challakere	8.02	0.084	344.96	147.26	198.24	72.70	5.598	39.02	0.770	6.786	0.32	Dull Reddish brown
S9	Challakere	8.24	0.092	376.32	155.40	234.08	51.98	5.480	15.25	1.058	3.452	0.22	Reddish brown
S10	Molakalmur	7.86	0.048	439.04	145.90	256.48	52.71	5.748	20.32	1.058	1.786	0.32	Dark Reddish brown
S11	Molakalmur	7.58	0.026	344.96	133.01	351.68	55.61	6.198	73.94	2.200	7.976	0.31	Dark Reddish brown
S12	Molakalmur	7.98	0.077	376.32	322.42	238.56	61.43	6.048	61.96	1.154	5.596	0.27	Dull Reddish brown
S13	Chithradurga	8.14	0.234	439.04	142.51	300.16	57.43	5.210	16.07	0.770	0.596	0.37	Brownish Black
S14	Chithradurga	8.04	0.064	282.24	337.76	192.64	73.24	4.550	14.75	1.826	0.596	0.25	Dark Brown
S15	Chithradurga	7.56	0.023	439.04	137.08	228.80	33.08	5.000	35.90	2.692	5.358	0.47	Brown
S16	Holalkere	7.32	0.041	376.32	152.01	155.68	106.5	5.598	68.36	1.634	8.690	0.25	Dark Brown
S17	Holalkere	8.75	0.079	439.04	147.26	56.00	51.80	5.508	34.92	0.866	6.548	0.30	Grey Color
S18	Holalkere	7.35	0.040	439.04	155.40	168.00	42.53	5.060	24.60	1.154	3.214	0.42	Dark Reddish brown

and maximum amounts Phosphorus were found in Hiriyr 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 with an average of 201.97 kg/ha. 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. Hiriyr 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 6.198ppm 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 (<4.5ppm) and 50% of soil samples were found under normal status (>4.56ppm) only 5% of soil samples were found to be of excess status of Iron content (>9ppm). Chithradurga taluk has minimum value of iron content (<4.5ppm) and Hosadurga taluk has maximum value of Iron content (>4.5ppm) (Shivakumar, 2013) (see table 2 and figure 9).

**Manganese**

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

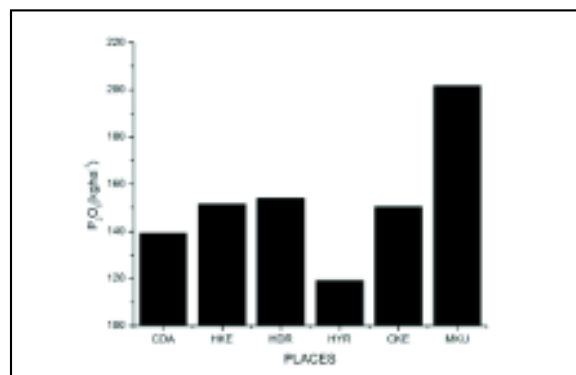


Figure 5: Variation of P<sub>2</sub>O<sub>5</sub> with Places

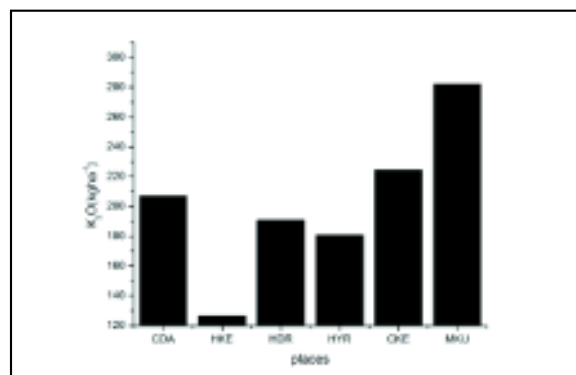


Figure 6: Variation of K<sub>2</sub>O with Places

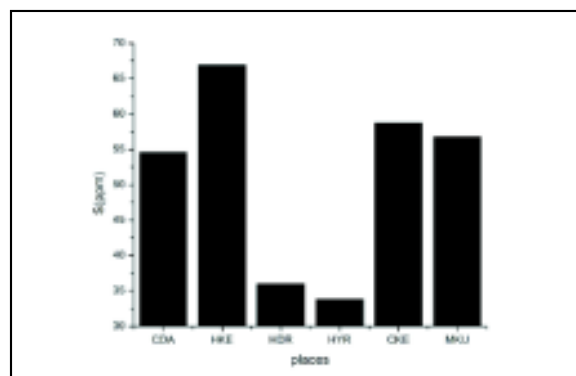


Figure 7: Variation of S with Places

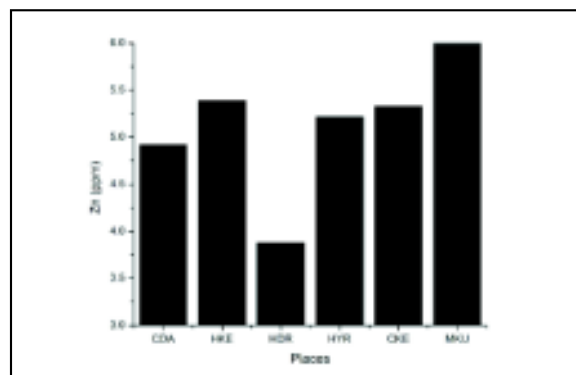


Figure 8: Variation of Zn with Places

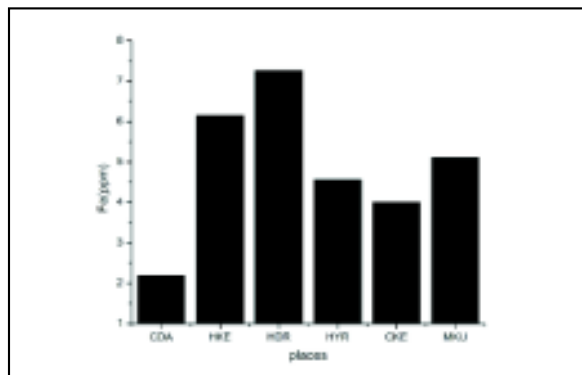


Figure 9: Variation of Fe with Places

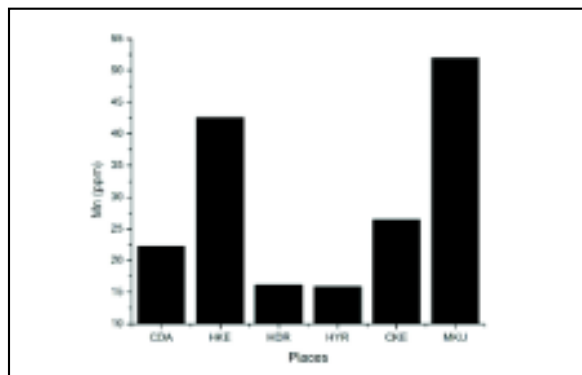


Figure 10: Variation of Mn with Places

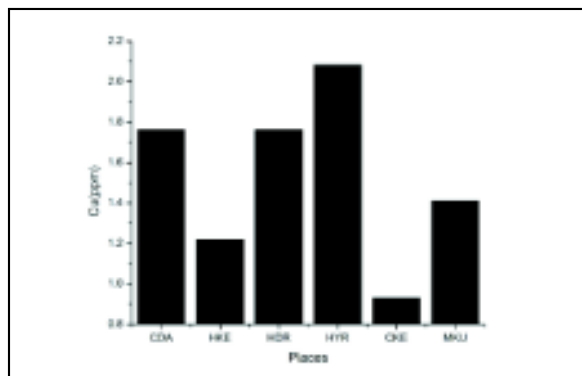


Figure 11: Variation of Cu with Places

29.24ppm, and all the soil samples have high value of manganese. Minimum value of manganese status is in Hiriyr 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 Hiriyr taluk has maximum value of copper in it (table 2 and figure 11).

Table 2: Average Values of Physico-Chemical Properties and Macro and Micro Nutrient Status

Sample No	Taluks	PH	EC dsm <sup>-1</sup>	N Kg/ha	P <sub>2</sub> O <sub>5</sub> Kg/ha	K <sub>2</sub> O Kg/ha	Zn Ppm	Cu Ppm	Mn Ppm	Fe Ppm	Sulphur (S) Ppm	Oc %
S1-S3	Hosadurga (HDA)	7.44	0.044	292.69	154.04	190.77	3.878	1.762	16.17	7.26	35.98	0.25
S4-S6	Hiriyr (HYR)	8.22	0.074	376.32	119.21	180.69	5.219	2.083	15.90	4.56	33.80	0.40
S7-S9	Challakere (CKE)	8.01	0.069	355.41	150.42	224.37	5.329	0.930	26.45	4.00	58.76	0.27
S10-S12	Molakalmur (MKU)	7.80	0.050	386.77	201.77	282.24	5.998	1.410	52.01	5.11	56.78	0.30
S13-S15	Chitradurga (CDA)	7.91	0.107	386.77	139.11	207.20	4.920	1.762	22.24	2.18	54.58	0.36
S16-S18	Holalkere (HKE)	7.80	0.053	418.13	151.55	126.56	5.388	1.218	42.62	6.150	66.94	0.32

## 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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