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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 is 8465 km^2. 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 draught 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* (S_1), *Buddigere colony* (S_2) *Tyjavalli* (S_3), *Yadavalla* (S_4), and *Verragarana Byranakoppa* (S_5). From Bhadravathi taluk: *Majjegenahalli* (S_6) *Belakkithanda* (S_7), *Kaddadakatti* (S_8), *Huliyaru Ramannakoppa* (S_9), and *Shankalipura* (S_{10}). From Thirthahalli taluk: *Tuduru* (S_{11}), Kudu mallige (S_{12}), Shankaramanne (S_{13}), Halige Kattikopa (S_{14}) and Kodlu (S_{15}). From Shikaripura taluk, Attibyalu (S_{16}), HariGupa circle (S_{17}) Bendikatti (S_{18}), Begur (S_{19}) and Muddanahalli (S_{20}), From Soraba taluk, Belavanne (S_{21}) Koddikanni (S_{22}) Jolladha Guddi (S_{23}), Guddavi (S_{24}) and Thavarahalli (S_{25}). From Sagar taluk, chikkanalur (S_{26}), Keladi (S_{27}), Balleshe Goda (S_{28}), Hyggena bylu (S_{29}) and Ahachapura (S_{30}). From Hosanagar taluk Sudurugate (S_{31}), Ripanpete (S_{32}), Muguduthi (S_{33}), Herijanni (S_{34}) and Koduru (S_{35}). 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)

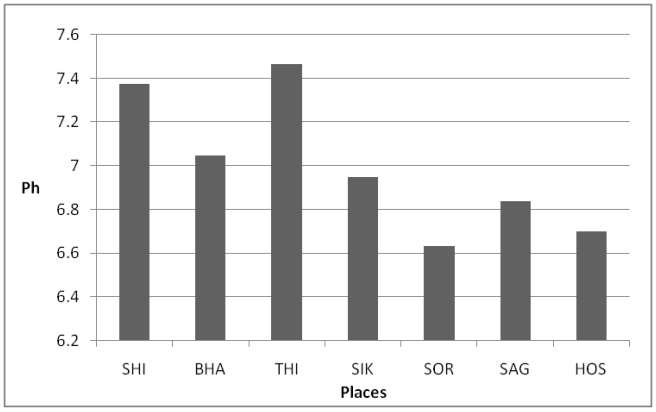

Figure 1: Variation of PH with Places

represent minimum value of 6.632 in Soraba taluk and maximum value of pH 7.464 in Thirthahalli taluk. The pH of the soil provides information regarding the potency of toxic substances present [4].

The electrical conductivity of soil samples varied from 0.014 to 0.094 dsm^{-1} (Table-1) with an average of 0.0395dsm^{-1}. On the basis of limits suggested by Muhr et al, [5], used for judging salinity of soils, all the samples were found to fall in low conductivity group. Data represented (Table-2/figure2) show that Soraba taluk has minimum value of conductivity and Shivamogga taluk has maximum value of conductivity. The electrical conductivity may be ascribed to the leaching of salts to lower horizons [6].

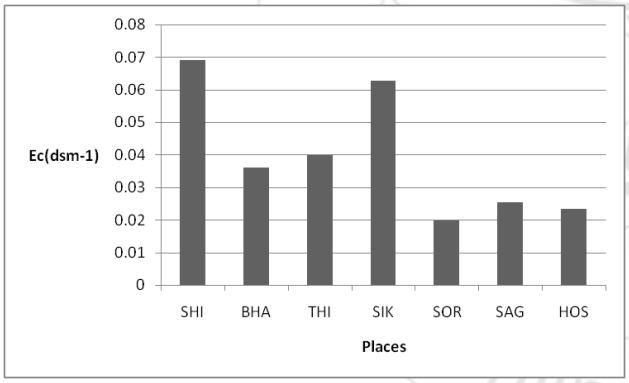

Figure 2: Variation of EC with Places

Nitrogen: Table-1 also shows the Nitrogen status varied from 62.72 to 250.88 $kgha^{-1}$ with an average value of 148.47 $kgha^{-1}$ on the basis of the ratings suggested by Subbiah and Asija[7], the available nitrogen for all the soil samples was found to be minimum. We infer (Table-2-figure 3) that

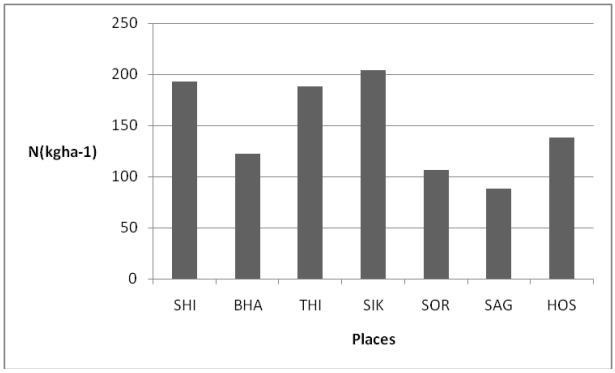

Figure 3: Variation of N with Places

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$kgha^{-1}$ with an mean value of 182.82 $kgha^{-1}$. 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.

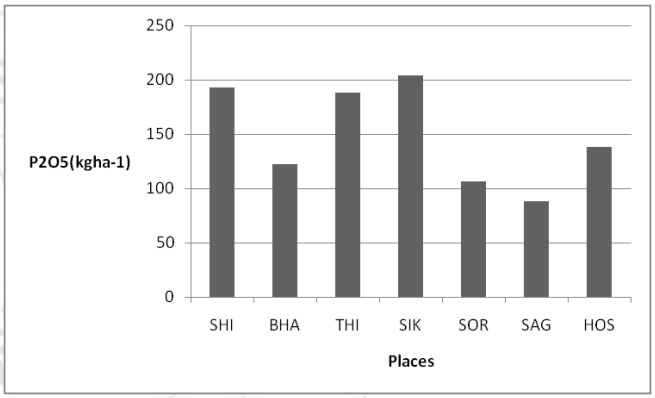

Figure 4: Variation of P_2O_5 with Places

Potassium: Table-1 further elucidates the available potassium status varied from 100 to 343 $kgha^{-1}$, with an average of 201.50 $kgha^{-1}$. 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.

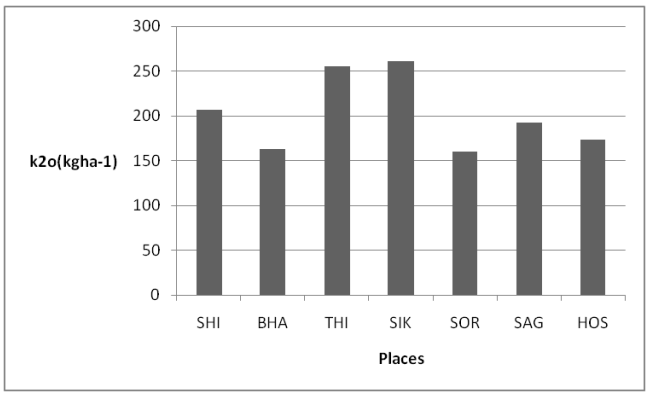

Figure 5: Variation of K_2O with Places

Sulphur: The data represented in Table-1 shows the available Sulphur status and varies from 2 to 94 ppm with

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).

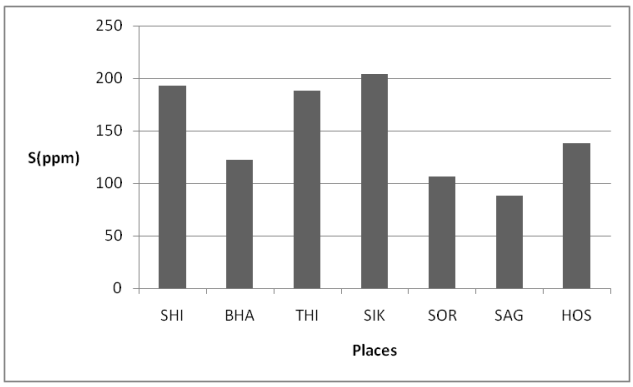

Figure 6: Variation of S with Places

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).

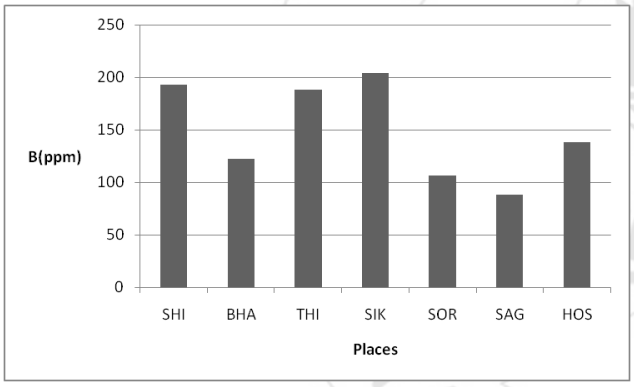

Figure 7: Variation of B with Places

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).

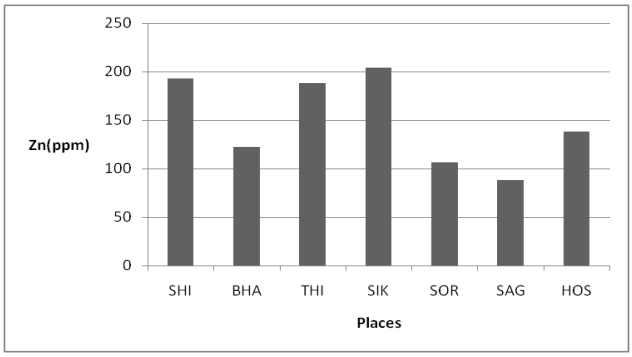

Figure 8: Variation of Zn with Places

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 oil 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).

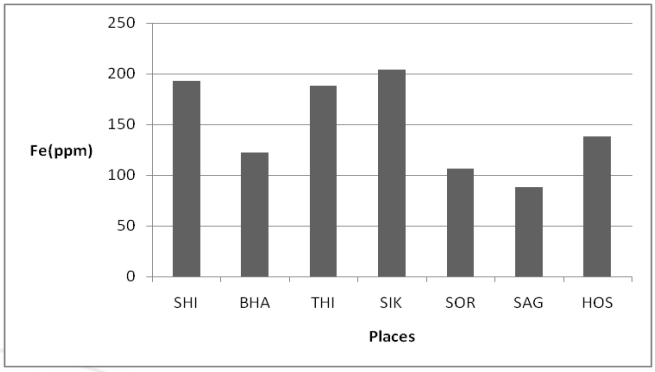

Figure 9: Variation of Fe with Places

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).

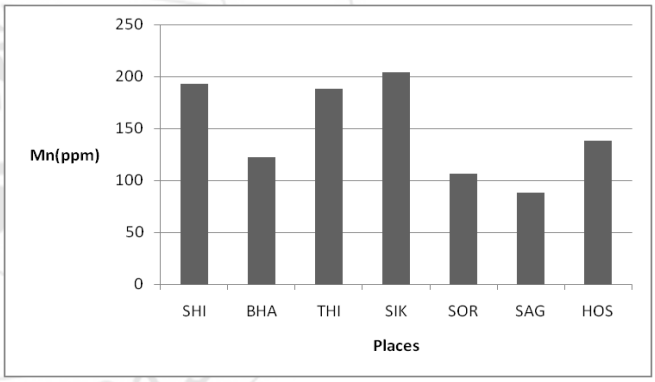

Figure 10: Variation of Mn with Places

Copper: The data shows (Table-1) the availability of copper and is found to vary from 0.84 to 6.31ppm with a mean value of 2.79ppm, 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).

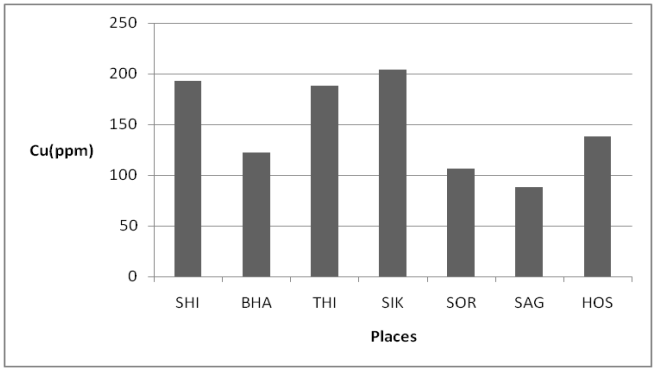

Figure 11: Variation of Cu with Places

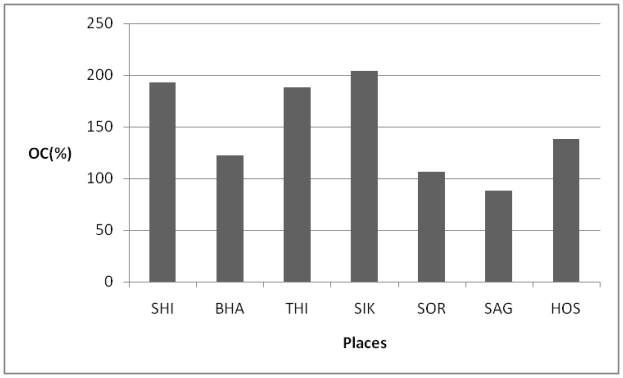

Figure 12: Variation of OC with Places

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

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

Sample No.	Taluk	PH	EC dsm^{-1}	N $kgha^{-1}$	P_2O_5 $kgha^{-1}$	K_2O $kgha^{-1}$	S ppm	B ppm	Zn ppm	Fe ppm	Mn ppm	Cu ppm	OC %	Color
1	Shivamogga	7.20	0.046	172.48	141.83	299.04	22.3	1.82	2.67	34.6	266	1.55	1.91	Dull Brown
2	Shivamogga	7.14	0.075	203.84	44.79	119.84	21.5	1.47	0.49	30.16	214.8	2.65	1.91	Dark Brown
3	Shivamogga	7.43	0.062	125.44	367.14	234.08	19.3	1.73	1.94	29.34	158.5	3.21	0.45	Brown
4	Shivamogga	7.14	0.069	250.88	460.79	172.48	20.6	1.52	1.58	34.7	117.6	5.62	1.59	Bright Brown
5	Shivamogga	7.96	0.094	235.20	80.08	206.08	32.2	1.33	2.04	28.1	94.54	2.35	2.77	Dark Reddish Brown
6	Bhadravati	6.88	0.066	109.76	91.61	215.04	13.8	1.73	1.53	5.68	45.46	2.22	2.27	Dull Yellowish brown
7	Bhadravati	6.91	0.029	188.16	302.67	132.16	8.6	1.49	2.78	5.36	36.66	2.65	2.54	Brown
8	Bhadravati	7.2	0.02	156.8	217.83	119.84	6.02	1.99	2.29	52.26	15.80	3.28	1.68	Dull Reddish brown
9	Bhadravati	7.15	0.043	62.72	146.58	231.84	3.44	2.16	0.68	43.76	18.57	3.50	2.1	Dull Yellowish brown
10	Bhadravati	7.09	0.022	94.08	259.23	116.48	3.44	1.66	0.97	6.53	5.17	3.91	0.12	Dark brown
11	Thirthahalli	7.84	0.086	219.52	30.54	150.08	16.3	1.40	1.07	29.26	66.09	2.36	1.63	yellowish brown
12	Thirthahalli	7.45	0.044	172.48	157.44	288.96	12.5	2.01	1.3	26.8	61.52	2.12	3.22	Dull yellowish brown
13	Thirthahalli	7.49	0.018	203.84	153.37	285.6	48.1	1.90	1.48	16.82	82.72	2.33	1.59	Orange
14	Thirthahalli	7.62	0.022	188.16	29.86	266.56	12.0	1.56	1.13	28.72	63.34	0.86	1.32	Bright Yellowish Brown
15	Thirthahalli	6.92	0.029	156.80	10.86	283.36	94.5	1.18	3.74	33.2	23.04	6.31	1.45	Reddish brown
16	Shikaripura	6.86	0.069	219.52	152.69	206.08	25.4	1.94	1.96	31.66	20.9	2.1	3.18	Brown
17	Shikaripura	7.00	0.068	172.48	53.61	255.36	27.9	1.35	1.4	35.18	31.52	1.3	1.91	Dark brown
18	Shikaripura	6.97	0.077	203.84	695.59	217.28	9.9	1.66	3.05	26.84	31.82	1.55	2.31	Dull yellowish brown
19	Shikaripura	6.89	0.051	219.52	418.71	295.68	7.3	1.26	2.27	6.89	30.3	0.84	2.52	Brown

20	Shikaripura	7.02	0.049	203.84	388.85	329.28	14.6	1.75	1.68	8.86	44.24	1.22	1.97	Brown
21	Soraba	6.57	0.016	125.44	111.29	110.88	5.59	1.73	1.16	48.56	30.70	3.88	1.08	Olive Brown
22	Soraba	6.62	0.02	125.44	138.43	120.96	2.15	6.59	2.10	35.50	33.46	3.43	0.36	Bright Reddish brown
23	Soraba	6.66	0.015	125.44	105.86	343.84	2.15	3.96	0.81	57.74	21.96	3.56	2.1	Reddish brown
24	Soraba	6.76	0.028	94.08	112.65	108.64	3.87	1.92	0.55	54.58	21.10	3.43	0.84	Dull Reddish brown
25	Soraba	6.55	0.02	62.72	120.79	117.6	2.15	4.26	0.94	52.36	28.60	3.72	2.46	Dull brown
26	Sagar	6.7	0.032	94.08	136.40	343.84	3.87	2.27	1.35	27.92	10.57	2.80	0.15	Bright brown
27	Sagar	7.05	0.024	94.08	321.66	116.48	6.88	1.66	0.74	50.78	32.60	3.05	2.04	Yellowish brown
28	Sagar	6.92	0.03	94.08	152.69	135.52	5.16	1.56	0.87	43.10	21.54	3.21	1.02	Dark brown
29	Sagar	6.71	0.027	62.72	161.51	185.92	6.88	1.97	1.19	52.26	23.96	3.15	0.36	Grayish brown
30	Sagar	6.82	0.014	94.08	127.58	179.2	8.60	5.07	1.29	59.40	11.63	3.31	1.5	Brown
31	Hosanagar	6.71	0.026	188.16	137.76	324.8	5.16	1.35	1.10	34.12	15.63	2.04	1.08	Brownish Black
32	Hosanagar	6.82	0.024	94.08	137.76	100.8	7.74	1.73	1.16	37.68	10.70	1.85	2.46	Dull Reddish brown
33	Hosanagar	6.61	0.03	94.08	194.08	182.56	2.58	2.72	2.16	17.82	6.40	2.39	0.3	Yellowish brown
34	Hosanagar	6.78	0.016	125.44	128.26	147.84	2.58	1.87	1.68	54.02	16.77	2.26	0.18	Dull yellowish brown
35	Hosanagar	6.59	0.021	188.16	107.90	108.64	3.87	0.99	1.26	52.00	15.97	3.43	0.54	Brown

Table 2: Average values of Physico-Chemical properties and Macro and Micro nutrient status

Sample no	Taluks	PH	EC dsm^{-1}	N Kg/ha	P_2O_5 Kg/ha	K_2O Kg/ha	Sulphur (S) Ppm	Boran B Ppm	Zn Ppm	Fe Ppm	Mn Ppm	Cu Ppm	Oc %
S1-S5	Shivamogga	7.374	0.0692	192.568	218.926	206.304	23.18	1.574	1.744	31.38	170.288	3.076	1.726
S6-S10	Bhadravathi	7.046	0.036	122.304	203.584	163.072	7.06	1.806	1.650	22.718	24.332	3.112	1.742
S11-S15	Thirthahalli	7.464	0.0398	188.16	76.414	254.912	36.68	1.61	1.744	26.96	59.342	2.796	1.842
S16-S20	Sikaripura	6.948	0.0628	203.84	341.89	260.736	17.02	1.592	2.072	21.886	31.756	1.402	2.378
S21-S25	Soraba	6.632	0.0198	106.624	117.804	160.384	3.182	3.692	1.112	49.748	27.164	3.604	1.368
S26-S30	Sagar	6.84	0.0254	87.808	179.968	192.192	6.278	2.506	1.088	46.692	20.06	3.104	1.014
S31-S35	Hosanagar	6.702	0.0234	137.984	141.152	172.928	4.386	1.732	1.472	39.128	13.094	2.394	0.912