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SOIL QUALITY STATUS OF TUNGA LEFT BANK COMMAND AREA SHIMOGA DAVANAGERE DISTRICT KARNATAKA INDIA

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Soil Quality Status of Tunga Left Bank Command area, Shimoga & Davanagere Districts, Karnataka, India

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Abstract: The success of soil management to maintain soil quality depends on an understanding of how soils respond to agricultural use and practices over a time. As a result, the important physico-chemical parameters of soils were studies under different land use systems. The Tunga Left Bank Canal Command (TLBC) area lies in between 75^0 31' to 75^0 40 E and 13^0 50' to 14^0 02' N forming a part of Shimoga and Davangere districts of Karnataka state. About thirty soil samples were collected in the study area during the pre-monsoon season (April-May 2007) and were analyzed for the physico-chemical parameters viz; pH, EC,N,P_2O_5, K_2O and micronutrients such as Fe, Mn, Zn and Cu. From the above study area it is noted that the physico-chemical parameters are in these range i.e., pH varies from 6.7 to 7.7, EC varies from 0.14 to 0.32 dSm^{-1} and available Nitrogen varies from 142 to 246 Kg/ha, available P_2O_5 varies from 14 to 27 Kg/ha, available K_2O varies from 135 to 173 Kg/ha. In the case micronutrients, Fe varies from 12 to 18 ppm, Mn varies from 5.0 to 8.1 ppm, Zn varies from 0.63 to 1.83 ppm and Cu varies from 0.36 to 1.1 ppm. The results obtained indicate that all the soil samples of the present study are within the permissible limits for agricultural purposes.

Key words: Land use system, Soil quality, physico-chemical parameters.

I. Introduction

Soil is a living system that represents a finite resource vital to life on earth. It forms a thin skin of unconsolidated minerals and organic matter on earth's surface. It develops slowly from various parents materials and it modified by time, climate, macro and microorganisms, vegetations and topography. Soils are complex mixtures of minerals, organic compounds and living organisms that interact continuously in response to natural and imposed biological, chemical and physical forces. People are dependent on the soil and conversely, good soils are dependent on the people and the use they make of the land. Soils are the natural bodies in which plants grow. Soil quality evaluation is a tool to assess management-induced changes in the soil and to link existing resource concerns to environmentally sound land management practices.In the present study an attempt has been made to know the soil quality of the Tunga command. Tunga Left bank canal (TLBC) is located in between longitudes 75^0 31' 00" to 75^0 40' 00" E and latitudes 13^0 50' 00" to 14^0 02' 00" N covering an area of 147.9 Sq.km. The area lies in the part of Shimoga and Davangere Districts of Karnataka state (Fig 1). The area under the project is in semidry zone, the mean annual rainfall in the study area is 814.90 mm during the period from 1991-2005. The monthly average temperature is 26.22^0C. The maximum temperature of 46^0C was recorded in March 1994 and a minimum of 09^0 C was recorded in month of December 1994. The average relative humidity of the study area is 63.64%. The relative humidity recorded at in the months of July to October (monsoon) varies from 84% to 54%, while in other months (pre and post monsoons) it varies from 91% to 22%. The study area has an average wind speed of 4.22 km/hr.

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II. Geology and Hydrogeology

The study area forms part of Shimoga schist belt, which is one of the important schist in Dharwar Craton. The Shimoga granite-gneiss is regarded as a mantled gneiss domal structure having grano-diorite composition (Syed Ali and Divaker Rao, 1980). This rock is compact gray in color and often jointed and most prominent ones are N25^0E to S10^0 E trending joints (Fig 3).The dip of this joint set varies from 50^0 to almost vertical, geologically TLBC consists essentially of gneisses, basal polymict conglomerate and quartz chlorite schist. Numerous quartz and pegmatite veins traverse all the litho units. In the study area Migmatites and grano-diorites to tonalitic gneisses of Archean age are confined to Northern part. Numerous exposures of migmatites are observed with steep slopes and high degree of weathering is more prominent at places. The general trend of the foliation is NNE-SSW. Presence of mylonitic fabric, δ-porhyroclasts and swearing of foliation indicates that gneisses of the study area have suffered intense deformation.

III. Soil Types

About 90% of the area of the study area is occupied by soils developed on granite-gneiss, and about 10% by soils developed on schist. The major types of soil occurring in the study area include red loamy soil and red sandy soil and black soil.

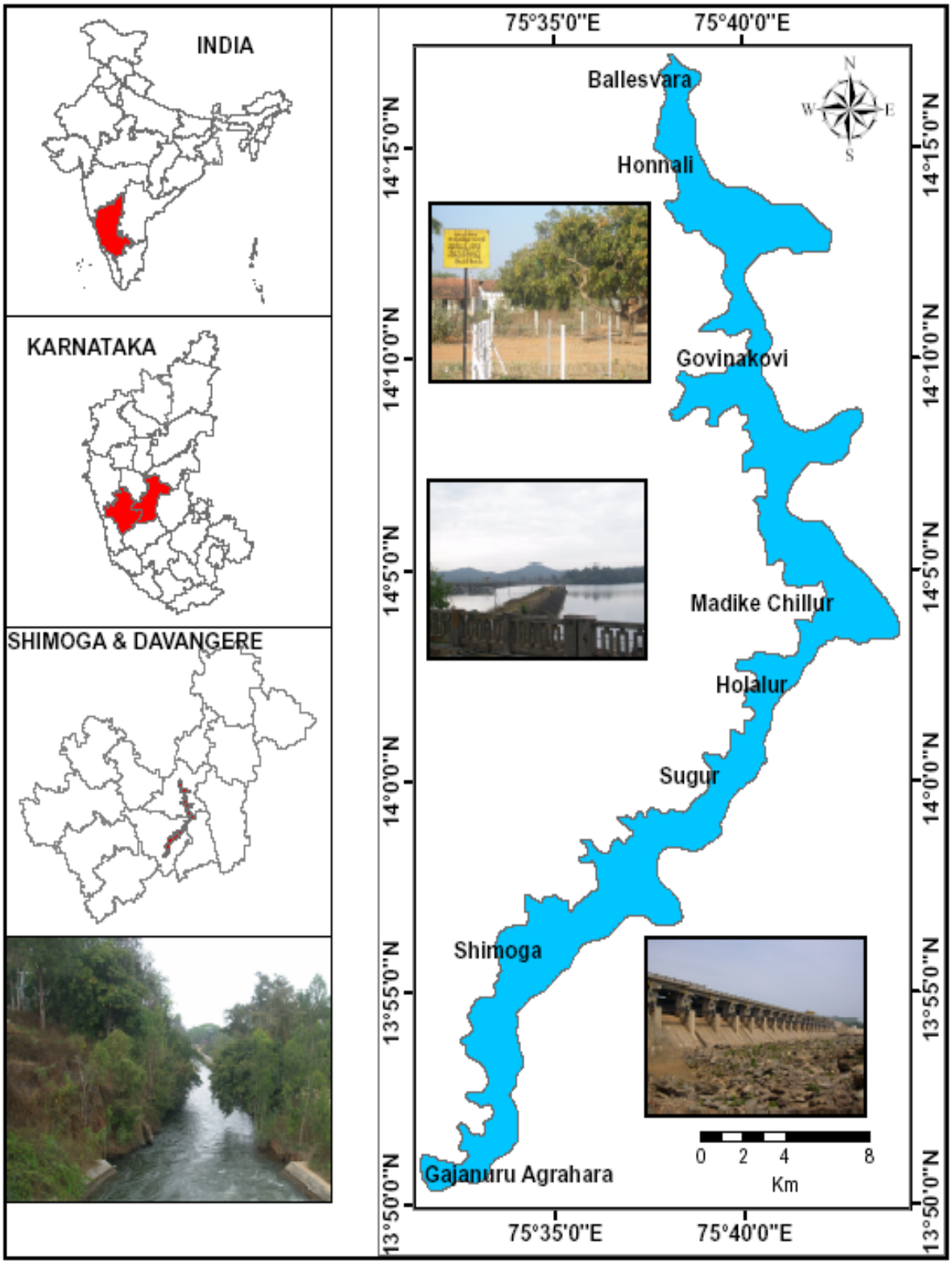


Fig 01: Location map of the Tunga Left Bank Command area

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IV. Methodology

Thirty soil samples, which have been collected during pre-monsoon and post-monsoon seasons of 2007 covering the entire TLBC (Fig 02). Soil quality has been analysis to determine the agricultural suitability following Indian Standard Procedures has been used (Titration method, Atomic Absorption Spectrophotometer (AAS) Thermo M5 Model). Aq.QA version 1.1 software has been used for the water quality evaluation. The collected soil samples were dried in air and then crushed in a wooden mortar with a pestle and sieved through a 2mm sieve to separate the coarse fragments (> 2mm). The fine earth samples were stored in separate containers for analysis. To qualitative analysis of the soils the following physical and chemical analysis were carried out, it include pH, EC available N, P and K. Soil pH has measured the in soil and water suspension in 1:1.5 ratio, 1 N KCl and 0.01 M $CaCl_2$ suspensions using a glass electrode pH meter (Sharma et al., 1977) and Electrical conductivity using Conductivity Bridge.Nitrogen content of the soil was determined by alkaline potassium permanganate method in this method 20 gram of soil mixed with 100 ml of $KMnO_4$ (32%) and 100 ml of NaOH (2.5%) are added and then distilled. Ammonia liberated has been collected in boric acid (4%) and mixed with indicator and then titrated against standard acid.Available Potassium is determined by preparing the extraction by neutral normal ammonium acetate and subsequently estimated using flame-photogrameter (J R Hall et al., 1976).The micronutrients elements were determined by AAS (Atomic Absorption Spectrophotometer) model Thermo M5. Thirty soil samples were analyzed for physico-chemical parameters and micronutrients and the data is presented in the (Table 1.1).

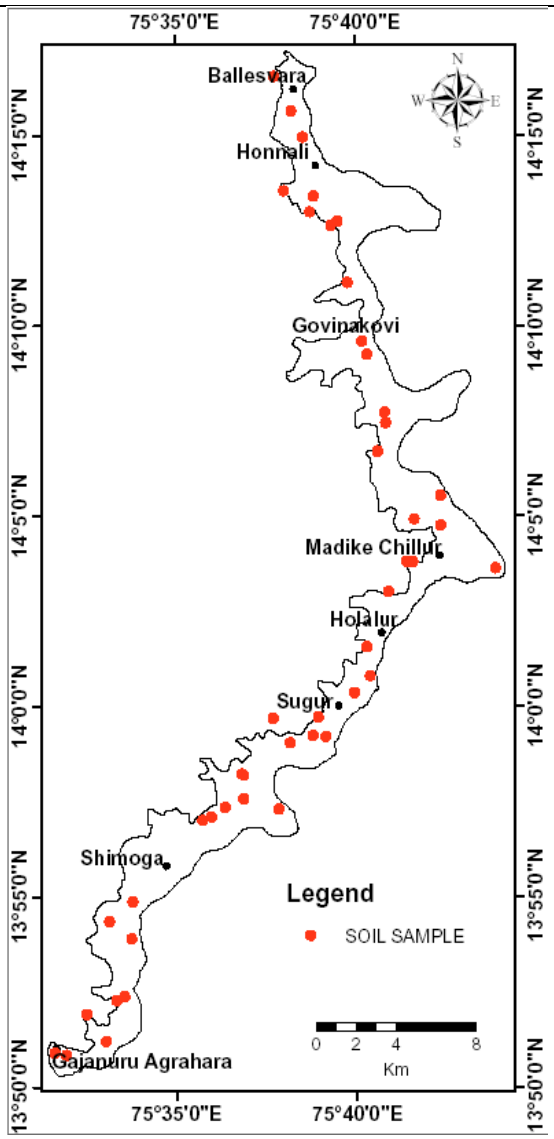


Fig 02: Location of Soil samples in TLBC

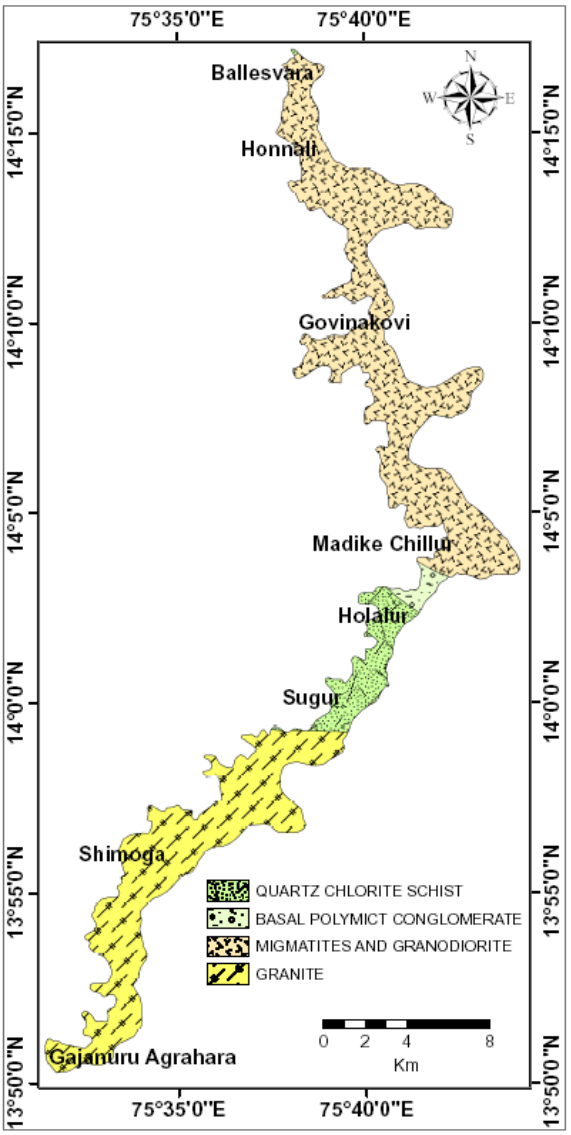


Fig 03: Geology Map of TLBC

V. Results and Discussion

a) Irrigation Soil quality Soil pH

pH is a measure of the acidity or alkalinity of a substance and soil pH is considered the single most important chemical property of soil because it affects the availability of essential plant nutrients. Acid soils have pH values less than 6.6, neutral soils between 6.7 and 7.72 and alkaline soils greater than 7.3. The pH of soil samples is ranging from 6.70 to 7.72 with an average of 7.29 indicating that the soils in study area within the Indian standard specification (6.5 to 8.5) and hence no amendments are required for the soils of the present study. Soil of TLBC belongs to neutral class (pH 6.7 – 7.7)

b) Electric Conductivity

Electrical conductance is the ability of an object to conduct electric current. It depends upon the presence of various ionic species in soil and the temperature at which measurement is made. EC of the soils of the present study area varies from 0.14 dSm^{-1} to 0.32 dSm^{-1}, indicating the soils are good for crop production as EC is $< 1\ \mu\ dSm^{-1}$.

c) Available Nitrogen (N)

Soils containing higher amounts of organic matter generally are capable of releasing higher quantities of nitrogen. Nitrogen is a mobile nutrient in the soil. Nearly all soils in TLBC require nitrogen for optimum production of crops requiring nitrogen uptake. The available nitrogen in a soil represents a fraction of the total N absorbable by plants. In soils of the present, the available nitrogen varies between 142.0 to 246.0 kg/ha with an average of 195 kg/ha. As per the Indian standard specification soils of the present study are low in available Nitrogen. Hence, they needs to be amended with organic manure (FYM/compost/vermi compost) /inorganic fertilizers (Urea/ 17; 17; 17 NPK).

d) Available Phosphorus (P_2O_5)

Crops and crop rotations require different levels of available phosphorus. Generally, even in row crops, it is recognized that phosphorus response varies. The available P in a soil represents a fraction of the total P which is susceptible to plant uptake during their growth. Plants take up P in H_2PO_4-, H_2PO_4+ forms but the water soluble P at any one time is very small. In the study area available P varies between 14 to 27 kg/ha with an average of 20.93 kg/ha. As per the Indian standard specification soils of the present study are low in available P. Therefore, they needs to be amended with SSP (16% P), DSP (32%P) and rock phosphate 24%P).

Amount of P_2O_5 (Kg/Ha)	Rating
<22.5	Low
22.9-56.33	Medium
>56.33	High

e) Available Potassium (K_2O)

Available K in a soil is generally the sum of water soluble and exchangeable potassium. The reserve forms of K in soils are the non-exchangeable K and the mineral K. As the exchangeable K of soils is removed through cropping or leaching, some of the reserve K derives from weathering of feldspars and micas and become exchangeable. In the soils of the present study area available potassium varies between 135 to 173 Kg/ha, with average of 156.4 kg/ha. In the study area, the concentration of potassium is maximum. As per Indian standard specification, soils of the present study are high in available K Hence, the use of fertilizers is more in the study area and it should be reduced to improve the soil quality.

K_2O (Kg/Ha)	Rating
<141	Low
141-136	Medium
>136	High

VI. Status of Micronutrients

Micronutrients are those, which are required in small quantities for the growth of plants and organisms.

a) Iron

In the soils of the study area, the concentration Iron varies between 12 to 18 ppm and average of 14.47 ppm and it is indicating that this soil is good for plantation and double crop. The iron concentration is maximum and minimum in the basin and this substantiates the presence of areca nut, coconut plantation and paddy fields.

b) Manganese

A manganese concentration in the soils of the present study varies between 5.00 to 8.10 ppm with an average of 7.20 ppm and indicates that these soils are good for plantation crops/horticulture.

c) Zinc

The zinc ratings and recommendations are for use in corn and grain sorghum. These recommendations are for a single corrective soil application that should last from three to five years. In the study area, the concentration of zinc varies between

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0.63 to 1.83 ppm, with an average of 1.34 ppm and it is exceeding the critical limits.

d) Copper

In the study area, the concentration of copper varies between 0.36 to 1.10 ppm, with an average of 0.619 ppm and it is exceeding the critical limits. The use of micronutrient fertilizers is more in the study area, it should be reduced to improve the soil quality by monitoring the levels with frequent soil tests and plant analyses.

VII. Conclusion and Recommendation

Learn to know how to produce more, while damaging the soil less. Plants are restricted by the nutrient in shortest supply, and they simply stop growing. But when soil organisms stop growing, all remaining free nutrients are eventually lost. So, a soil short of nitrogen but rich in all other essential nutrients will lose all of these if nitrogen is not supplied. The purpose of the present study is assessing the soil quality to protect and improve long-term agricultural productivity and habitats of all organisms including people. In the summery there is lack of good drainage system in the study area in low laying lands. The N and P shows low rating and K shows medium rating in the soils of the present study. Higher concentrations of Cu were noticed in the soils, which is probably due application of Bordeaux mixture (it is copper sulfate mixture and contain 1% copper) in order to control diseases koleroga and application of excessive inorganic fertilizers.Hence, educating everyone involved in agriculture about the importance of soil and agricultural practices to be done according to the soil quality factors and water availability and the crops should be grown accordingly and about the essence of soil. Proper soil and crop management is certainly the safest and least costly ways to prevent pollution of our surface and ground water.

Sample No.	Location	Latitude	Longitude	pH	EC (dSm^{-1})	Avail. N (Kg/h	Avail. P_2O_5 (Kg/ha)	Avail. K_2O (Kg/ha)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
1	Gajanur	13^0 50' 50.9"	75^0 31'57.1"	7.56	0.25	246	24	162	15	8.00	1.60	0.65
2	Veerapura	13^0 51' 54.8"	75^0 32' 30.7"	7.60	0.26	208	27	136	14.5	7.00	1.70	0.70
3	Hosahalli	13^0 52' 23.1"	75^0 33' 33.8"	7.50	0.30	216	23	150	13	7.40	1.65	0.40
4	Shimoga	13^0 54' 21.3"	75^0 33' 08.4"	7.64	0.18	230	25	148	12.5	7.20	1.73	0.70
5	Mandli	13^0 54' 52.1"	75^0 33' 47.5"	7.68	0.25	220	27	135	14	8.10	1.30	0.65
6	New Mandli	13^0 57' 0.03"	75^0 35' 43.8"	7.72	0.28	234	23	138	13	7.60	1.50	0.70
7	Harakere	13^0 57' 20.8"	75^0 36' 21.0"	7.60	0.30	215	20	152	13	7.00	1.30	0.52
8	Pilangere	13^0 57' 17.9"	75^0 37' 50.1"	7.60	0.24	218	24	162	12	6.90	1.42	0.56
9	Hanaswadi	13^0 58' 13.2"	75^0 36' 49.3"	7.18	0.27	230	20	170	17	7.23	1.30	0.70
10	Bedara Hosahalli	13^0 59' 02.4"	75^0 38' 09.6"	7.20	0.15	208	23	165	14	7.90	1.45	0.50
11	Bedara Hosahalli	13^0 59' 13.9"	75^0 38' 47.4"	7.06	0.21	204	19	160	13	8.10	1.80	0.61
12	Hosahalli	13^0 59' 41.1"	75^0 37' 41.1"	7.10	0.26	210	17	164	18	8.06	1.70	0.60
13	Near Bullapura	13^0 59' 43.1"	75^0 38' 56.3"	7.08	0.15	198	20	170	13	7.20	1.83	0.40

14	Bullapura	14° 00' 21.5"	75° 39' 56.8"	7.02	0.20	200	14	163	15	7.00	1.60	0.52
15	Hale Hatti	14° 01' 33.5"	75° 40' 17.3"	6.92	0.30	164	16	154	17	6.40	0.90	0.40
16	Holalur	14° 03' 00.8"	75° 40' 53.6"	6.98	0.26	158	17	168	18	6.10	1.20	0.62
17	Madikechiluru	14° 03' 47.5"	75° 41' 34.0"	7.30	0.20	175	19	159	13	6.00	0.92	0.60
18	Hale Malali Hosahalli	14° 04' 44.9"	75° 42' 20.4"	7.01	0.24	183	18	160	12	7.10	0.63	0.45
19	Hosahalli	14° 04' 55.2"	75° 41' 36.4"	7.42	0.18	180	23	173	15	7.25	1.26	0.80
20	Chiluru	14° 06' 42.2"	75° 40' 35.9"	7.40	0.20	169	25	151	15	7.60	1.30	0.60
21	Distributory no 7	14° 07' 43.0"	75° 40' 47.5"	6.85	0.25	142	20	148	18	7.90	0.90	0.65
22	Kuruva	14° 09' 14.3"	75° 40' 18.2"	7.60	0.20	198	24	168	12	5.00	1.26	0.55
23	Haranahalli	14° 11' 07.7"	75° 39' 46.0"	7.68	0.32	190	20	172	16	6.50	1.20	0.60
24	Sunkadakatte	14° 12' 44.4"	75° 39' 29.5"	6.89	0.18	164	23	150	17	7.70	1.36	0.50
25	Sunkadhakatte	14° 12' 59.1"	75° 38' 44.2"	7.70	0.22	188	27	170	13	8.10	1.20	0.63
26	Sunkadakatte	14° 12' 59.1"	75° 38' 44.2"	7.40	0.26	200	18	165	12	7.20	1.40	0.70
27	Herematkere	14° 13' 32.5"	75° 38' 00.8"	7.02	0.16	180	23	145	14	7.15	1.10	0.36
28	Honnali	14° 14' 56.9"	75° 38' 32.4"	7.06	0.18	168	14	143	15	8.00	1.15	0.80
29	Konayakanahalli	14° 15' 38.0"	75° 38' 13.2"	6.70	0.14	174	16	140	17	7.10	1.26	1.10
30	Lambanithanda	14° 16' 32.8"	75° 37' 44.5"	7.12	0.26	180	19	152	13	6.40	1.36	1.00

Table 1.1: Results of physico-chemical analysis of soils

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