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Full Length Research Article

Studies on the Physico-chemical Parameters of Soil Samples at the Vicinity of Sugar and Fertilizer Industries in Karnataka

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ABSTRACT

Soil analysis provides an important information about physical nutrient conditions and chemical properties that influence the soil health. In the present investigation the physico-chemical studies of soils are carried out for the various soil samples viz of has shown in graph S1, S2, S3, S4 collected from North and South regions of Karnataka at the vicinity sugar and fertilizer industries. The results have indicated that soil sample S1 has Shown Heavy clay soil texture, lowest electrical conductivity, available Nitrogen, Potassium, Sulphur and Iron content and also showed maximum level of exchangeable calcium and magnesium content. Soil sample S2 has maximum water holding capacity, Highest range of EC, slightly alkaline pH, more organic carbon and organic matter, available Nitrogen, lower phosphorous and Iron content. Soil sample S3 has acidic pH, Maximum range of Phosphorous, Copper, Iron and Zinc Content. Soil sample S4 and indicates the lowest water holding capacity, Lower content of moisture, organic carbon and organic matter, lower level of exchangeable calcium and magnesium content, lowest copper content and showed maximum potassium and Sulphur content. These variations in soil physico-chemical parameter certainly influenced the distribution of soil micro-fauna and soil health.

***Key words*:** Soil texture, Water holding capacity, Electrical conductivity, pH, Soil moisture, Organic carbon and organic matter, Available nitrogen, Phosphorous, Sulphur, Copper, Iron, Zinc, Exchangeable calcium, Magnesium

Soil is a dynamic entity and has complex interactions with its biological chemical and physical components. Soil plays important role in to quantify the physical, chemical and biological parameters that impacts on the agricultural productivity and sustainability. Soil physic-chemical properties influence the behavior of soil and hence, knowledge of soil property is important [1]. Soil testing is the only way to determine the available nutrient status in soil and the only way we can develop specific fertilizer recommendations [2]. The physical and chemical parameters influence the soil productivity. The soil is a complex organization being made up of many constituents namely inorganic matter, organic matter, soil organisms, soil moisture, soil solution and soil air. Soil contains 50-60% mineral matter, 25-35% water, 15-25% air and low organic matter [3]. A collection of Soil samples from Chamrajanagar district (S_1) and Mangalore (S_3) of South regions, Gadag (S_2) and Koppal (S_4) districts of north regions of Karnataka. The soil samples were collected by standard procedures and in polythene bags stored at 5°C in laboratory. These soil samples are analyzed to measure various physico-chemical parameters by standard methods. Soil is made of various components; the composition of soil and proportion of these component greatly influence on the soil physical properties which is include the soil structure and porosity. These properties influence air and water movements in soil and thus the ability of soil function.

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MATERIALS AND METHODS

Soil samples, all laboratory chemical reagents, apparatus etc. were used for physical and chemical analysis of soil samples. Soil samples were collected at random at the rate of 3 samples per plot (30cmx30cm) every three months (Quarterly). Samples were drawn by stainless steel corer by quadrant method of 30cm x30cm (inner cross-section diameter 8.5 sg/cm) from a depth of 5-10cm. Separate soil samples units (500grms) were taken from each site preserved in polythene bags for further usage as per Mandal and Suman 2014.

Sampling and analysis-location

The soil samples were collected from Chamarajanagar district (S_1) and Mangalore (S_3) of South regions Gadag (S_2) and Koppal (S_4) of North regions of Karnataka. All the chemicals and reagents used for analysis are A R Grade from S. D. Fine and Sigma chemicals, Mumbai Analysis of physico-chemical parameters of the soil samples were suspended in distilled water (1:4 w/v) and allowed to Settle down the particles [4]. The physico-chemical analysis of soil samples S_1,

S_2, S_3 and S_4 have been performed to know its different parameters like soil texture, water holding capacity, EC, pH, moisture content, percentage of organic carbon and organic matter available nitrogen, phosphorous, potassium, sulphur, copper, iron, zinc, exchangeable calcium and magnesium.

The soil texture was determined by using sieve set by sieving technique, soil moisture by moisture meter. The soil water holding Capacity determined by funnel filtration method or Gooch crucible method, electrical conductivity of the soil sample was determined in the filtrate of the water extract using conductivity meter. The pH of the Suspension was determined by using pH meter, organic carbon ion Suspension was determined by colorimetric method, organic matter in Soil samples estimated by Spectrophotometer, Available nitrogen determined by Kjeldahl Method, Available Phosphorous was determined by Bray's method using Spectrophotometer, Available Potassium determined by Flame Photometer, Available Sulphur determined by Turbid metric method using Spectrophotometer. The exchangeable calcium and magnesium, copper, iron and zinc were by AAS (Atomic Absorption determined Spectroscopy) (Manual Soil testing in India, January 2011).

RESULTS AND DISCUSSION

Soil physico-chemical parameters

Physico-chemical properties of Soil samples were studied and our observation indicated that all the samples were reddish to brown in colour. Correlate of the texture with the observable soil micro-fauna in the area from which the soil samples has been collected. In sandy soil, the non-capillary pore spaces will be more and the capillary pore spaces will be less [5]. The condition will be reversed in case of clay soil. The pore space in turn determines water holding capacity, percolation rate, aeration, moister content and soil micro-fauna. Clay particles are anionic colloids and absorb minerals nutrients and minimize their leaching S_1 shows heavy clay, S_2 and S_3 are clayey sandy whereas S_4 is clayey loamy [6]. The variation in water holding capacity is due to varying proportion of sand, silt and clay in the soil of different study areas. soil with very high proportion of sand have very low water holding capacity due to large pore spaces between the particles which enables the water to percolate freely into deeper layers leaving upper layer partially dry [7-9]. In clay soil due to fine capillaries and small size of pore spaces the water is retained in the capillary spaces as capillary water. In their soil the water does not percolate freely. Soil with more or less equal proportion of sand. Silt and clay (loamy soil) combines the properties of sand and clay and capacity. The pH range of 6.8 to 8.0 is recommended optimum pH for soil Health and soil micro-fauna. The pH of soil samples shows range 6.67 to 7.94 slightly acidic to moderately alkaline in nature [10-11]. The electrical conductivity of soil samples shows variation in values from 0.08 to 1.15 ms/cm. This suggests normal soil which has no deterious effect on soil health. The percentage of carbon from 0.43 to 0.59 shows normal soil. Hence S_1 and S_2 has normal range where as S_3 and S_4 has low carbon content. The percentage of available nitrogen of S_1 was low, S_2, S_3, S_4 was medium. The percentage of available phosphorous was abnormal and shows very high content in all soil samples. The percentage of potassium of S_1 and S_3 was medium, S_2 and S_4 was totally high abnormal in range. The available Sulphur shows 3-5 mg/kg normal range in all soil samples. The high potassium content can be correlated with high organic matter and organic carbon in sample S_2. This may be because high potassium boosts uptake of nitrogen and phosphorous in soil organism. The ratio of exchangeable calcium and magnesium ranger between 3.5 to 6.0 this has never proven to be of significance [12]. The copper shows permissible limit of 0.5 mg/kg S_1, S_2, S_3 abnormal range S_4 has slightly higher the range of normal. The iron normal range is 3 mg/kg S_1 is normal S_4 slightly higher than the normal S_1 and S_3 has abnormal range. All S_1, S_2, S_3, S_4 soil abnormal range. All S_1, S_2, S_3, S_4 soil samples have normal values of zinc content. Hence the range of physico-chemical parameters has both positive and negative influence on soil health conditions and on soil organisms [13].

Table 1 Physic- chemical parameters of soil samples

Soil samples	S_1	S_2	S_3	S_4
Soil texture	Heavy clay	Clay sandy	Clay sandy	Clay loamy
WHC (ml/50g)	17	19	18	15
Moisture (%)	0.57	0.31	0.38	0.11
Electrical Conductivity (1:2) (ms/cm)	0.193	0.712	0.463	0.547
pH (1:2)	7.28	7.94	6.67	7.64
Organic carbon (%)	0.51	0.59	0.35	0.23
Organic matter (%)	0.879	1.017	0.603	0.396
Available nitrogen (kg/ha)	198.80	280.00	252.00	274.40
Available phosphrous (kg/ha)	61.03	49.32	46.30	56.01
Available potassium (kg/ha)	264.62	434.56	299.79	472.75
Available sulphur (mg/kg)	1.051	2.095	2.228	2.607
Exchangeable calcium (Meq/100g)	3.50	3.30	1.90	1.80
Exchangeable magnesium (Meq/100g)	6.50	5.70	3.90	2.20
Copper (ppm) mg/kg	3.95	5.75	6.80	1.744
Iron (ppm)	42.88	1.67	108.00	9.786
Zinc (ppm)	1.57	2.37	10.30	4.29

CONCLUSION

The physico-chemical study of various parameters is most essential to maintain soil health and population and distribution of soil micro-fauna. These studies provide us the information on the nature of Soil and its productivity. The nature of Soil micro-fauna in turn would be diverse at the vicinity of Sugar and fertilizer industries in both north and South Karnataka which is evident by our present findings of physic-chemical parameters. So that we can maintain the soil health by managing the pollutants released from the industries which is chosen for the studies.

Conflict of interest

The authors hereby declare no conflict of interest.

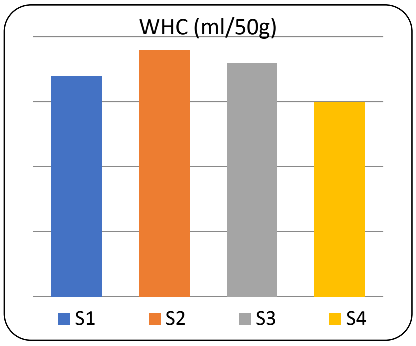

Fig 1 Water holding capacity (ml/50g)

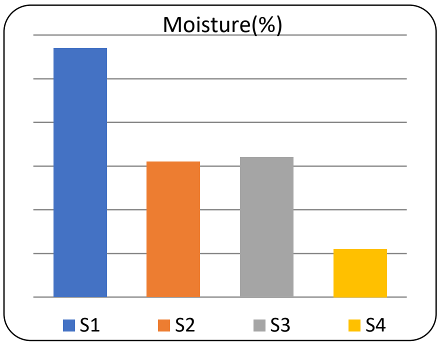

Fig 2 Moisture (%)

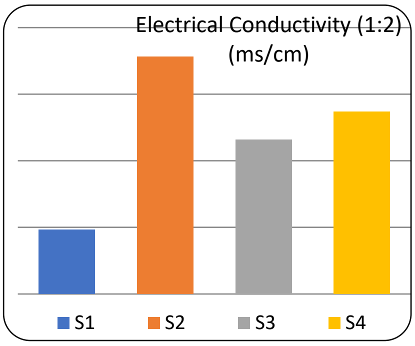

Fig 3 Electrical conductivity (1:2) (ms/cm)

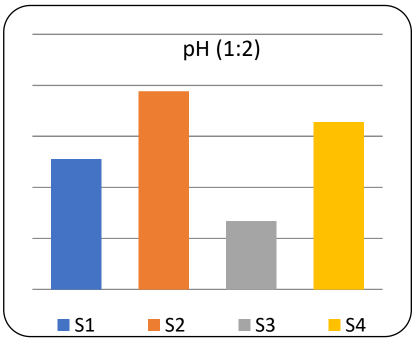

Fig 4 pH (1:2)

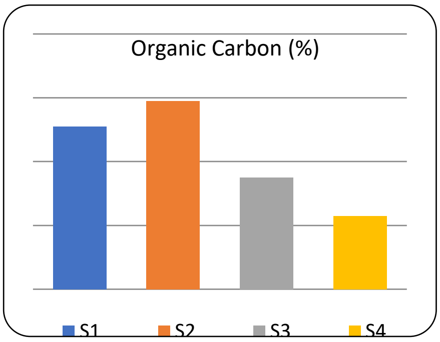

Fig 5 Organic carbon (%)

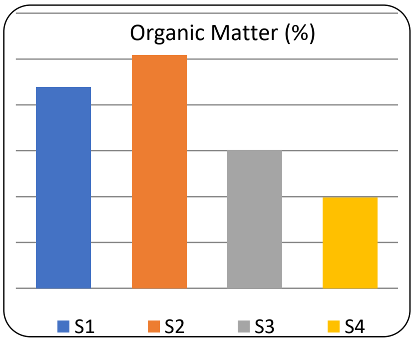

Fig 6 Organic matter (%)

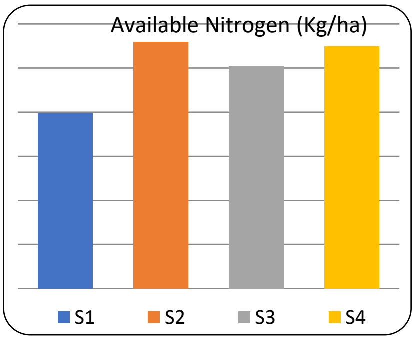

Fig 7 Available nitrogen (kg/ha)

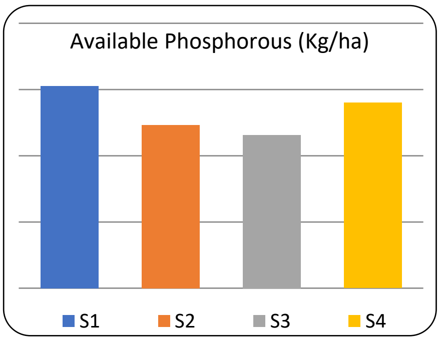

Fig 8 Available phosphorous (kg/ha)

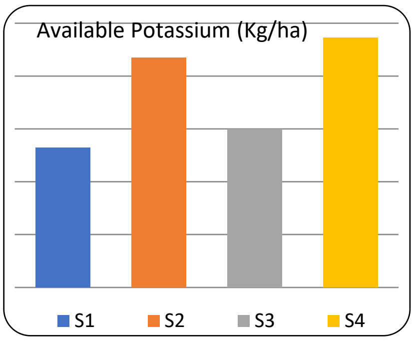

Fig 9 Available potassium (Kg/ha)

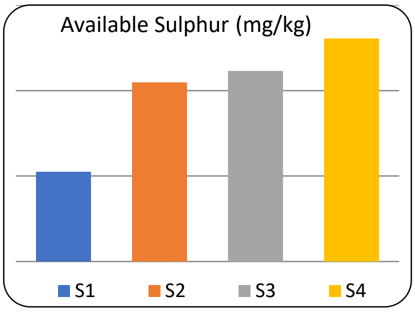

Fig 10 Available Sulphur (mg/kg)

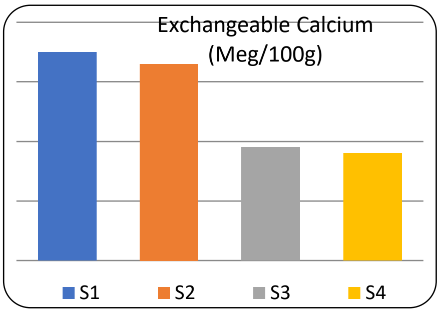

Fig 11 Exchangeable Calcium (Meg/100g)

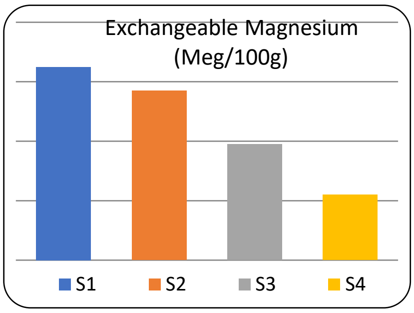

Fig 12 Exchangeable Magnesium (Meg/100g)

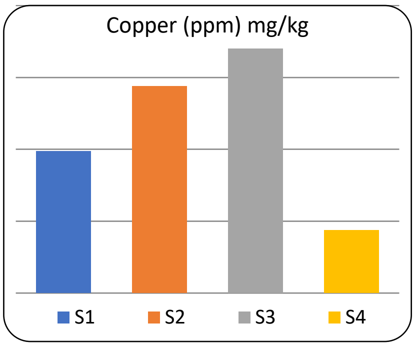

Fig 13 Copper (ppm) mg/kg

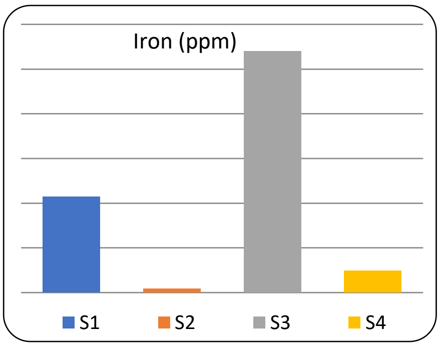

Fig 14 Iron (ppm)

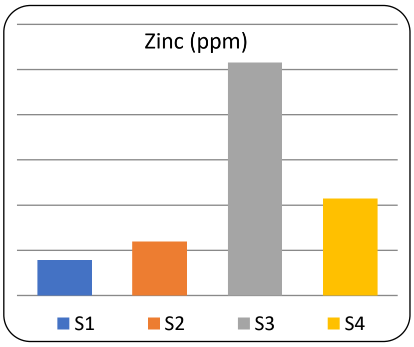

Fig 15 Zinc (ppm)

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