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Physico-Chemical Analysis of Soil Status of Various Degraded Sites in an around Dimoria Tribal Belt of Assam, India

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Abstract: ***Soil is a very important material for plants and as well as animals and humans for their activities. It is very essential to determine the soil characteristics to know the soil quality. In the present study an attempt has been made to analyze the physico-chemical properties of soil in degraded site with special reference to control site. The soil parameters like pH, Organic Carbon (OC%), Water Holding Capacity (WHC), Soil Moisture Content (SMC), Bulk Density, Available N, P & K, Zn, Mn, Fe, Cu etc. were analyzed. The pH value showed a range of 7.0 to 6.3 in the site 1, 7.3 to 5.8 in the site 2, 5.8 to 5.2 in the site 3 and 4.6 to 4.7 in the site 4. The moisture content ranges from 12.68% to 19.15%, 10.51% to 18.06%, 1.32% to 1.31%, and 17.23% to 5.39%. The water holding capacity is highest in the site 4 and lowest in the site 3. The result of the study also shows low levels of P, K, and Organic Matter. Chemical parameters were found decreasing with increasing of soil depth. In most cases Bulk Density was high in lower subsoil in comparison with surface soil.It was found that there was a marked variation in nutrients and parameters of various samples in different selected sites.***

Keywords: Soil, physico-chemical, Degraded, organic carbon, soil sampling

1. Introduction

Soil the uppermost layer of the earth crust, is one of the most important natural resources that exist since it is the basic sustaining life on the planet. Soil is the soul of infinite life and is generally refer to the loose material composed of weathered rock and other materials including partly decayed organic matter. Soil is a complex organization being made up of some six constitution namely inorganic matter, organic matter, soil organism soil moisture, soil solution, and soil air. Roughly, the soil contains 50-60% mineral matter, 25-35% water, 15-25% air and little percentage of organic matter[1]. Soil is a natural body consisting of soil horizons of mineral constituents of variables thicknesses, which differ from the parent materials in their morphological, physical, chemical and mineralogical characteristics. Soil is composed of particles of broken rock that have been altered by chemical and mechanical processes that include weathering and erosion. In the recent years of development in all the fields industries are playing very important role. Even every country looking towards globalization through industrialization. The opening of an industry gives rise to increase in the economy of the country through creating number of jobs. The economy of that area is depends on the job opportunities provided by industry. Due to industrialization, most of the biodiversity, soil, surrounded by the industry get polluted and even some times it may be destroyed[2]. Due to discharge of effluents directly or after treating to the surface nearby its industrial area soil get contaminated. Soil pollution is caused by the presence of xenobiotic and other alteration in the natural soil environment [3]. Usage of pesticides, leakage of storage tanks, oils etc can cause soil pollution. Dumping of waste material can leach the toxic substance and penetrate towards soil[4]and may cause underground water pollution also. And Most of the industries use chemicals for production, machineries could cause soil contamination. However roadways and automobiles are now considered as one of the largest sources of soil pollution. Zinc (Zn), Copper (Cu), Cadmium (Cd) and Lead (Pb) are four most common heavy metals released from road travel, automobiles contain 90% of the total metal concentration[5].

2. The Study Area

The Dimoria Tribal development block is situated in the south-eastern part of the Kamrup District of Assam and on the south bank of river Brahmaputra. It is bounded by Meghalaya on the south, by Morigaon District on the North-East and Greater Guwahati city on the west up to Jorabat (Amerigog). Dimoria Developmental block lies between 26^0N and $26^014'$N latitudes and $91^051'$E and 92^0 $10'$E longitude. The climate of this region is extensively and heavily influenced by the monsoon climate. The area falls under sub tropical monsoon climate. The average annual temperature is 27^oc and the average annual rainfall is about 200cm [6]. So, rainfall is abundant and widespread. Forest type of Dimoria developmental block are semi evergreen and mixed deciduous with the presence of occasional sub-tropical broad-leafed forest.

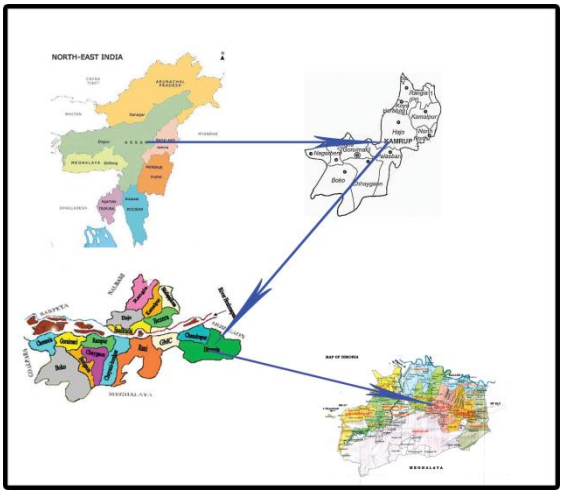

Figure 1: Study area map

3. Methods

3.1 Selection of Sampling Station

For the purpose of this study samples were collected from three industrial sites. Total three soil samples were collected from the two depths i.e. (0-15cm) and (15-30cm).

3.2 Sampling Procedure

Soil samples were collected randomly from the two depths (0-15cm) and (15-30cm) grasses, mosses, litter and other residues were removed from soil surface. Soil was collected in plastic bag, which were sealed and labelled properly. Before analysis, the samples were spread out thinly on a piece of paper for drying in air shade. The big lumps were broken down and plant roots, pebbles and other undesirables matter were removed. After the soil become completely dry it was sieved through a 2mm sieve [7]. The samples were preserved in clean sealed polythene bags for chemical analysis.

3.3 Sampling site

Table 1: Various Sampling Sites

Serial. No.	Sampling site	Site
1	KMC	1
2	Star Cement factory	2
3	J.D Brick factory	3
4	Control site	4

3.4 Sample analysis

Table 2: The different parameters that were used to assess soil quality of different sites

Parameter	Methods
Texture	Feel method[6]
Bulk density	Core sampling method[6]
Moisture content	Oven dry method[7]
Organic carbon	Colorimetric method[7]
Water holding capacity	Oven dry method using brass box[8]
Ph	Electronic pH meter[9]
Available nitrogen	Mridparikshak method
Available Potassium	Flame photometer[10]
Available phosphorus	Bray's method[11]
Zn,Mn,Fe,Cu	Atomic absorption Spectrophotometer[9]

4. Result and Discussion

Soil texture is a qualitative classification tool used in both the field and laboratory to determine the classes for agricultural soils based on their physical texture. Soil in different regions shows different texture, the texture of the soil is mostly depends upon the size of particles. Texture of the study site was sandy clay loam to clay. Comparing the bulk density of the soil from studies sites with that shown in the table 3.The bulk density follows a positive increase with increasing depth except in the site 4.The increased organic matter results into more porosity and thus an increase in bulk density. Moisture is one of the most important properties of soil. The comparatively high soil moisture is found in case of the control site and low moisture is found in the degraded site. Organic carbon plays an important role as a source of plant nutrients and in maintaining the soil integrity. The organic carbon value was found to be medium in all the soil sample site. The organic carbon value generally decresase with increasing depths a number of factors influence the rate of decline of soil organic carbon levels fine textured, clay soils hold much more than sandy soils for two reasons, firstly clay particles from bonds that hold organic compounds. Secondly, decomposition occurs more quickly in well aerated sandy soils. Water holding capacity is used to identify the land that is suitable for crop production. The water holding capactity is high in case of the control sites since there was loads of organic matter present in the soil that holds the water within itself but it was low in case of the study sites since the area had very low vegetation and thus relatively very low organic matter that resulted into low water holding capacity. Soil pH is the measure of the hydrogen ion concentration i.e. acidity or alkalinity of the soil. pH can affect the availability of nutrients and activity of many essential microrganisms. The study area, being a industrially degraded site, had a Neutral pH in the site 1,medium acidic to neutral in the site 2, strongly acidic to medium acidic in the site 3 and very strongly acidic in the site 4. The pH value gradually decreasing with increasing depths. Nitrogen is the most critical element obtained by plants from the soil and is a bottleneck in plant growth[12]. The nitrogen value is high in the site 4 and moderately low in the site1, 2&3. The low value of nitrogen is due to less value of organic carbon. Phosphorus is a most important element in every living cell[13]. The amount of phosphrous found in the degraded site and contol site was very low level and is due to the application of various chemicals in the study sites result into an increase the formerly acidic soil in most of the sites. Potassium plays an important role in different physiological process of plants, it is one of the important element for the development of the plant. The Potassium value was found in the soil sample of the different site was low.. The low potassium content of the soil from different sites is due to the low moisture content of study site soil. The value of zinc, iron, copper and manganes was found in all the sites was high [14]. The value of zinc, copper, iron and manganes is high in the degraded site is due to chemical used in the industries. Mahajan et.al[15]carried out work on the study of physic-chemical parameters like pH and potassium from July 2008 to June 2009. During the study year fluctuation was observed in parameters. Investigation results showed that the soil alkaline throughout the study year. This finding is not match with my work.

Chandra Sharma[6], 2015 carried out work on the study of physiochemical parameters like pH, moisture content, bulk density, available phosphorus and available potassium etc. Investigation result showed that the soil was acidic in almost all the samples the average moisture content of the soils ranges from 16.1% to 24.31% , bulk density of the soil ranges from 1.07gm/cm^3 to 1.41gm/cm^3, the average amount of phosphorous in the soil ranges from 7.92kg/ha to 15.82kg/ha and average amount of potassium in soil ranged from 7.92 to 15.82 kg/ha. This finding is not match with my work. Shivanna et.al[16].carried out work on the fertility status of selected command areas of three lakes- Eachanur, V. Mallenahalli and Hallkurke in tiptur Taluk. The variables tested include pH ,N, P, K. The study revealed that the pH of the soil samples ranged from 7.07 to 7.87 and was on slightly alkaline side. Available nitrogen ranged from 54.825kg/ha to 85.72kg/ha; available phosphorous ranged from 5.33kg/ha to10.79kg/ha and the sample were nitrogen and phosphorus deficient. Potassium ranged from 156.18kg/ha to 434.38kg/ha and samples were of medium rating except one sample of high rating with respect to potassium. This finding is not match with my work.

Table 3: Physico-Chemical Parameters of Soil

N	D/(T)	P^H	MC (%)	WHC(%)	BD(gm/cm^3)	OC (%)	N(kg/ha)	P(kg/ha)	K(kg/ha)
1	0-15 /(LS)	7.0	12.68	18.68	1.13	0.42	285.5	0.04	39
	15-30/(LS)	6.3	19.17	13.16	1.14	0.24	170.2	0.03	17
2	0-15/(LS)	7.3	10.51	16.38	1.04	0.72	229.9	0.09	80
	15-30/(LS)	5.8	18.06	8.28	1.36	0.34	153.02	0.03	23
3	0-15/(LS)	5.8	1.32	6.77	1.15	0.67	335.5	0.05	32
	15-30/(LS)	5.2	1.31	15.16	1.17	0.14	170.2	0.02	12
4	0-15/ (C)	4.6	17.23	36.97	0.89	0.70	385.6	0.02	21
	15-30/ (C)	4.7	5.39	30.29	0.69	0.13	109	0.05	19
N= Sample, MC= Moisture Content, WHC= Water Holding Capacity, BD=Bulk Density, OC= Organic Carbon N=Nitrogen, P= Phosphorous, K= Potassium, Zn= Zinc, Fe= Iron, Cu= Copper, Mn=Manganes, D/(T)=Depth (cm) with Soil Texture, LS=Loamy Sand, C=Clay.						**Zn(ppm)**	**Fe(ppm)**	**Cu(ppm)**	**Mn(ppm)**
						1.83	16.36	2.27	10.28
						1.93	17.32	2.37	16.84
						3.83	11.36	2.49	15.37
						3.02	17.04	2.56	16.79
						1.83	16.36	2.27	10.28
						1.94	16.39	2.34	16.24
						3.64	18.68	4.55	16.36
						1.22	15.37	2.15	13.50

5. Conclusion

The present study reveals the level of physical and chemical value in the degraded soil of Dimoria Tribal belt of Assam ,India. Physico-chemical analysis is a useful tool for the immediate assessment of materials like soil. A wide variation in the physico-chemical properties of soils in degraded site was found in the present study. In the present investigation soil samples of the degraded site show pH value ranges from neutral to slightly acidic on the other hand control site pH is very strongly acidic, NPK value of all soil samples were found to be very less,Mn Cu Fe has a high ranges in both the two depths in the selected site. The water holding capacity of all the soil samples were found to be high in the control site and low in the degraded sites. On the basis of organic carbon soil moisture, it shows a very low concentration it is clearly indicated that the soil of industrially degraded area has lost their fertility. The rapid growth of population and technological and industrial have brought enormous problems and degradation of our environment.

6. Future Scope

Heavy metal like zinc damage soil very badly and it effect on the soil quality. So it can be minimized by soil physical and chemical analysis.

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