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Original Article

The Effects Of Urbanization On Different Edaphic Factors.

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Abstract

Soil is considered as the most important ecological component for terrestrial environment. In this paper an attempt was made to draw a relationship between different edaphic factors of soil namely, organic carbon, organic matter, pH and water holding capacity. The study revealed that these factors were interdepended and different from that of suitable amount in the present study areas and that was probably due to rapid and huge urbanization and deforestation.

Keywords: *Organic carbon, water holding capacity, soil fertility.*

INTRODUCTION

Plants absorb atmospheric carbon-di-oxide(CO_2), which is then reduced through photosynthesis so that the carbon component is retained and the oxygen(O_2) is returned to the atmosphere. The carbon that is retained by plants may be transferred to the soil via roots or decomposing plant residues. Soil carbon may be returned directly to the atmosphere from the soil, when the organic material in which it is held is oxidized by decomposition or burning. Soil organic carbon(SOC) refers to the amount of carbon stored in the soil- it is expressed as a percentage. SOC is closely related to the amount of soil organic matter (SOM). Soil carbon improves the physical properties of soil. It increases the cation exchange capacity and water holding capacity of sandy soil and it contributes to the structural stability of clay soils by helping to bind particles into aggregates (Lal, 2008). Soil organic matter, of which carbon is a major part, holds a great proportion of nutrient leaching and is integral to the organic acids that make minerals available to plants. It also buffers the soil from strong changes in pH. It is widely accepted that the carbon content of soil is a major factor in its overall health. Equilibrium between the rate of decomposition and rate of supply of organic matter is disturbed when forests are cleared and land use is changed. Bhattacharyya *et al.*(2008) reported that the Himalayan zones, with dense forest vegetation, cover nearly 19% of India and contain 33% of SOC reserves of the country. Sheikh *et al.* (2009) has studied a comparison of the soil organic carbon stock values of different sites in the forests of Garhwal Himalalya and showed that the carbon stock tones per hectare decrease with increasing altitudes and that may be due to better stabilization of SOC at lower altitudes. Soil organic carbon is important for all three aspects of soil fertility, namely chemical, physical and biological fertility (Chen, 2008). As a food source for soil fauna and flora, soil organic matter plays an important role in the soil food-web by controlling the number and types of soil inhabitants which serve important functions such as nutrients cycling and availability, assisting root growth and plant nutrient uptake, creating burrows and even suppressing crop diseases. Normally the pH values of soil lie between 2.2 and 9.6 . In India, acidic soils (pH below 5.5-5.6) occur in the state of West Bengal, Tripura, Manipur, and Assam in India. The pH of soil control the concentration and availability of other minerals also. Neutral or slightly acidic soil however is the best for the growth of majority of plants (Verma and Agarwal,2005). The district of Howrah, is densely populated and an important industrial zone of West Bengal, India. Due to continuous deforestation and rapid urbanization the present study area is suffering from dry soil surface as well as scarcity of green vegetation. Keeping all these views in mind present study was conducted.

MATERIALS AND METHODS

Collection Sites: The study areas were located in and around Shibpur of Howrah district, West Bengal, lies between latitude 22°48' N and 22°12' N, longitude 88°23' E and 87°50' E, which is a highly populated residential as well as industrial area. Five places were selected from both residential and nonresidential area to compare different edephic factors.

Beside Padma Pukur :- This place is situated near Padma Pukur water purification plant. This place is a area without natural vegetation.

Dinanta Asar:- This place is situated beside the road side near Electricity distribution centre. Some big trees are present in this area but regular clear off is taken place at the base of the trees.

Botanical Garden :Two places were selected inside the Botanical Garden.

i. beside the Ganga river and

ii. beside the lake. These study sites contain both natural and artificial vegetation.

Bananta Abasan Housing Complex.

Soil was collected at random from a depth of 6" at early morning, between 6 and 6.30 am. Three soil samples were taken for each experiment, then an average was done.

Following tests were conducted with the soil samples from these areas-

i. Estimation of Soil Organic Carbon (SOC) and Soil Organic Matter (SOM) by Ferrous ammonium sulphate titration method (Walkley & Black, 1934).

ii. Determination of pH of soil sample by pH meter (Systronics μ Lab Meter 9001 MCT, Accuracy ± .01).

iii. Estimation of Water Holding Capacity (WHC) by Keen's box method (Chattopadhyay, 1998).

Data were subjected to statistical analysis including correlation coefficient, regression equation and significance level (t – value). For graphical representation Wolfram Mathematica 7.0 software was used.

RESULTS AND DISCUSSION

The study revealed that Soil Organic Carbon (SOC) of Padma Pukur near the pond was 0.62%, 1.32% in Dinanta Asar , 2.05% in Botanical Garden beside the Ganga river , 2.14% in Bananta Abasan and 2.26% in Botanical Garden beside the lake (Table 1).

Table 1:- Amount of different edaphic factors of five places.

Soil Properties	*Papma Pukur Area*	*Dinanta Asar*	*Botanical Garden Beside The Ganga River*	*Bnanta Abasan*	*Botanical Garden Beside The Lake*
SOC %	0.62	1.32	2.05	2.14	2.26
SOM %	1.07	2.31	3.53	3.69	3.77
SOIL pH	6.46	7.63	7.46	7.43	7.13
SOIL WHC %	47.80	29.47	57.35	33.36	45.10

Presence of soil organic matter (SOM) in Padma Pukur area was 1.07%, 2.31% in Dinanta Asar, 3.53% in Botanical Garden beside the Ganga river, 3.69% in Bananta Abasan and 3.77% in Botanical Garden beside the lake.

Soil pH of Padma Pukur aear was 6.46, 7.13 in the Botanical garden beside the lake, Bananta Abasan was 7.43 ,7.46 in Botanical Garden beside the Ganga river, 7.63 in Dinanta Asar.

Water Holding Capacity (WHC) of soil of Dinanta Asar was 29.47%, 33.36% in Bananta Abasan,45.10% in Botanical Garden beside lake, 47.80% in Padma Pukur area near the pond, 57.35% Botanical Garden beside the Ganga river.

When the correlation was done between SOC and SOM , it was found significant ($r=0.998$, $P < 0.01$)and the regression equation was $Y=0.0575+1.6778x$ (Fig. 1).

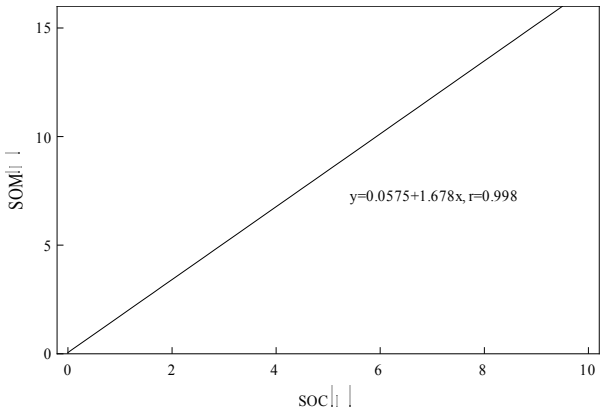

Fig 1.relationship betweenSOC and SOM

The SOC and pH showed good relation (r = 0.614, P > 0.05 level) and their regression equation was Y= 6.536+0.408x (Fig. 2). Similarly SOM and pH have good relation (r = 0.6415, P>0.05) and their regression equation was Y= 6.492+0.0253x (Fig.3). In both cases pH was not highly correlated with SOM and SOC.

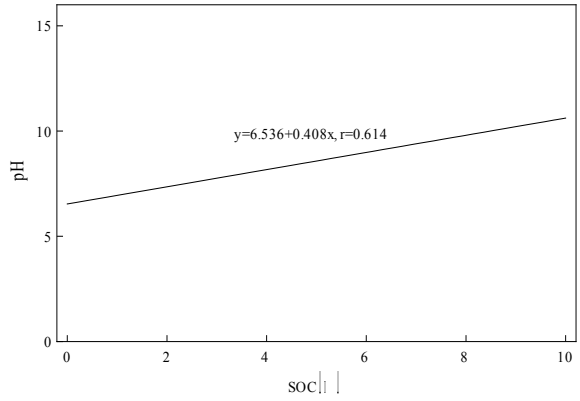

Fig.2: Relationship between SOC and soil pH.

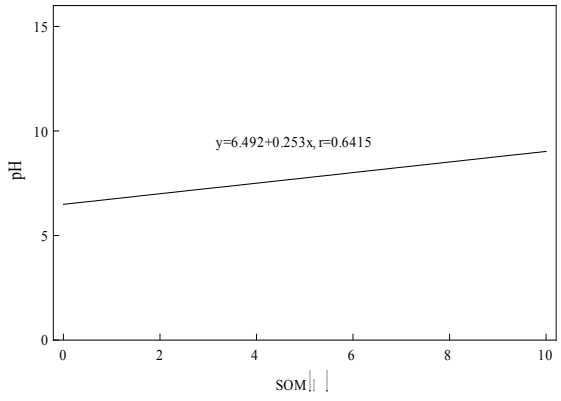

Fig.3: Relationship between SOM and soil pH.

The present study revealed that pH in these areas(6.46-7.43) which was towards alkaline in nature . Neutral or slightly acidic soil, however , are best for the growth of majority of plants (Verma and Agarwal, 2005). SOM enhances soil water retention because of its hydrophilic nature and its positive influence on soil structure. Increasing SOM increases soil aggregate formation and aggregate stability, thereby increasing porosity in the range of pore sizes that retain plant-available water and enhancing infiltration and water retention throughout the rooting zone. When SOM decrease, soil aggregation and aggregate stability decrease.

These changes in the physical properties result in lower infiltration rates and higher susceptibility to erosion.

It was also observed that Padma pukur area had lowest SOM (1.07%) with a pH of about 6.46, in comparison to other areas ,whereas, SOM was highest (2.26) in Botanical Garden that had a pH of about 7.13, which indicated a relationship between SOM and pH. The study revealed low SOM in the residential area which also indicated the less WHC.

From the present study it is cleared that the amount of SOC, SOM, WHC and pH in the soil of these areas were different from that of suitable amount for plant growth. Soil pH was slightly alkaline, but slightly acidic pH is suitable for normal growth of plants. Due to rapid and huge urbanization and deforestation in these areas, the fertility of soil have been reduced to great amount. The edaphic factors of the soil of these areas might be possible to return in its normal condition by plantation and proper use of land.

CONCLUSION

The task of conserving the natural ecosystem and indeed the urban forestry sector rest on every citizen particularly the urban dwellers that reside and transact their business in the metropolis since they are more vulnerable to the impacts of environmental hazard. Intensive and extensive urban forestry extension and education of the urban dwellers could serve as a necessary tool to create the required enlightenment that is capable of dissuading the wrong impression that urban forestry development is the sole responsibility of the state government alone.It was also observed that the respondent's appreciated the environmental services provided by the trees in the metropolis and as a source of domestic fuel; hence they should be made to Plant Avenue and multi-purpose trees around their dwelling for sustained and improved environmental services which include reducing heat intensity, improving air quality, curbing the advance of desertification by serving as windbreak and shelterbelts, fixing sand dunes thereby encouraging agricultural activities which will in turn improve their livelihood strategies. Adequate funding by the state government should be provided to the sector for enhanced and sustainable projects implementation including the establishment of woodlots in the state metropolis would help in ameliorating the environmental hazards occasioned in the metropolis. Tree nurseries should also be established across the state where seedlings could be produced at large quantities for projects implementation and public procurement to enhance private participation.

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